C8. Preliminary Geotechnical Investigation Report

Terraprobe

Consulting Geotechnical & Environmental Engineering
Construction Materials Inspection & Testing

PRELIMINARY GEOTECHNICAL INVESTIGATION
DIXIE ROAD (REGIONAL ROAD 4)
QUEEN STREET TO 2.1 km NORTH OF MAYFIELD ROAD
REGION OF PEEL, ONTARIO

Prepared for: AECOM
300 Town Centre Boulevard, Suite 300
Markham, Ontario
L3R 5Z6

Attention: Mr. Travis Brown, PMP, MTE
Manager - Transportation

File No. 1-10-5140

June 15, 2011

Distribution:

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1. INTRODUCTION

Terraprobe Inc. was retained by AECOM to provide geotechnical design information for the proposed improvements to Dixie Road from Queen Street to approximately 2.1 km north of Mayfield Road in the Region of Peel, Ontario. A site location plan is provided as Figure 1 and site photos are presented as Figures 2A and 2B.

Initially, the south and north project limits were Queen Street and Mayfield Road respectively and Terraprobe previously completed geotechnical work for this portion of the assignment. Reference is made to the following geotechnical report.

- Terraprobe Limited "Draft Preliminary Geotechnical Investigation, Dixie Road (Regional Road 4), Queen Street to Mayfield Road, Region of Peel, Ontario," File No. 1-08-3219, dated June 23, 2009.

The north project limit was subsequently extended to about 2.1 km north of Mayfield Road and this report provides geotechnical design information for the revised project limits. The purpose of this investigation was to determine the subsurface conditions along the alignment and to provide preliminary geotechnical design recommendations to support a Schedule "C" Class Environmental Assessment Study.

2. PROJECT AND SITE DESCRIPTION

Dixie Road is a north-south oriented four-lane roadway that generally conforms to an urban cross-section between Queen Street and Countryside Drive. From Countryside Drive to the north project limit the roadway narrows to a two lane rural cross-section. The roadway is approximately 9,265 m long within the project limits and intersects Queen Street, Howden Boulevard, Williams Parkway, Northampton Street, North Park Drive, Bovaird Drive, Peter Robertson Boulevard, Sandalwood Parkway, Countryside Drive and Mayfield Road.

Two significant culverts cross Dixie Road within the project limits. The first culvert is a 29 m long concrete box culvert located approximately 300 m north of Queen Street. The second culvert is approximately 30 m in length and is located about 1,400 m north of the Dixie Road/Mayfield Road intersection. A large storm water facility is located at the north east corner of the intersection of Dixie Road and Bovaird Drive.

We understand that a phased implementation plan is being proposed for the ultimate 6-lane widening of Dixie Road from Queen Street to 2.1 km north of Mayfield Road.

3. FIELD PROCEDURE

A visual pavement condition survey was conducted in May 2009 to evaluate the condition of the existing pavement from Queen Street to Mayfield Road and the roadway extending from Mayfield Road to the north project limit was evaluated in August 2010. The initial field investigation from Queen Street to Mayfield Road was conducted during the period of October 09 to 15, 2008. Additional field investigations were undertaken on July 28, 2010 for the section extending from Mayfield Road to the north project limit.

A total of forty-seven boreholes were drilled and sampled to depths ranging from 0.6 m to 9.6 m below ground surface. Boreholes 21 and 31 were not drilled due to conflicting utilities. The pavement was also cored at seven selected locations. The boreholes and coreholes were located in the field by Terraprobe Inc. in relation to existing features and their approximate locations are shown in Figures 3A to 3H.

Boreholes extended through the existing roadways were drilled with a truck mounted drill rig supplied and operated by Drilltech Drilling Ltd. of Newmarket, Ontario and Groundwork Drilling Inc. of Etobicoke, Ontario. Boreholes were also extended in the boulevard areas by advancing a split-spoon sampler with portable hand operated vibratory equipment (Pionjar).

Where conventional drilling equipment was used to drill the boreholes, representative samples of the strata penetrated were obtained from the boreholes, using a split-barrel sampler advanced by a 63.5 kg hammer dropping approximately 760 mm. The results of these Penetration Tests are reported as "N" values on the borehole logs at corresponding depths.

Members of Terraprobe's technical staff observed the coring, drilling, sampling and in-situ testing operations on a full time basis. Samples obtained from the boreholes were inspected in the field, sealed in clean plastic containers and transferred to Terraprobe's laboratory for further visual examination by a geotechnical engineer. Geotechnical laboratory testing consisted of water content determination on all samples and grain size analyses and Atterberg Limits tests on selected samples. The asphalt cores were transported to Terraprobe's laboratory for visual examination, measurement and photography. The results of the boreholes are presented in Appendix A.

Water level observations were made in the open boreholes during and immediately after completing the drilling operations. Borehole 34 was instrumented with a standpipe piezometer to permit longer term ground water level monitoring.

The ground surface elevation of Borehole 34 was referred to the City of Brampton benchmark I3-410 located on the west side of this culvert 144 m north of Hillside Drive. The elevation of this benchmark is 217.35 m. The ground surface elevation of Borehole 10-5 was referred to a temporary benchmark established on the top north-east corner of the existing concrete culvert located at approximately Sta. 16+420. A value of 100.0 m was assigned to this TBM.

4. SUBSURFACE CONDITIONS

Reference is made to the Log of Borehole sheets in Appendix A for details on the encountered soil stratigraphy. An overall description of the stratigraphy is given in the following paragraphs under three sections viz. Pavement Structure and Shoulders and the two Culvert Sites. However, the factual data presented in the Log of Borehole Sheets governs any interpretation of the site conditions. The subsurface conditions were confirmed at the borehole locations only and conditions may vary between and beyond.

4.1 Pavement Structure and Shoulders

The pavement structure of Dixie Road and the intersecting sideroads are tabulated below. Pavement core data and photographs are included in Appendix C.

Dixie Road from Sta. 7+800 to Sta. 14+150	
Pavement Component	**Typical Average Pavement Thickness (mm)**
	Main Lanes
Asphalt	150
Granular Base/Subbase	470
Total Average Pavement Thickness	620

Dixie Road from Sta. 14+150 to Sta. 15+000		
Pavement Component	**Typical Average Pavement Thickness (mm)**	
	Main Lanes	**Shoulders**
Asphalt	155	-
Granular Base/Subbase	610	655
Total Average Pavement Thickness	765	655

Dixie Road from Sta. 15+000 to Sta. 17+050		
Pavement Component	**Typical Average Pavement Thickness (mm)**	
	Main Lanes	**Shoulders**
Asphalt	140	-
Granular Base/Subbase	700	755
Total Average Pavement Thickness	840	755

Pavement Component	**Main Lanes - Typical Average Pavement Thickness (mm)**			
	Mayfield Rd. (East Leg)	**Countryside Drv. (West Leg)**	**Sandalwood (East Leg)**	**Peter Roberston (East Leg)**
Asphalt	260	165	110	115
Granular Base/Subbase	550	470	470	365
Total Average Pavement Thickness	810	635	580	480

Pavement Component	**Main Lanes - Typical Average Pavement Thickness (mm)**			
	Bovaird Drv. (East Leg)	**North Park Drv. (East Leg)**	**Williams Pky. (West Leg)**	**Howden Blvd. (East Leg)**
Asphalt	140	140	135	140
Granular Base/Subbase	620	320	325	660
Total Average Pavement Thickness	760	460	460	800

Gradation analyses were conducted on seven samples of the granular fill comprising the pavement structure of Dixie Road and the results are referenced to OPSS Granular A and Granular B Type I specifications. These results are illustrated in Figure B1 in Appendix B.

The granular fill is in a compact to very dense state based on SPT "N" values that ranged from 12 to 84 blows for 0.3 m penetration. The moisture content of this fill ranged from 1% to 6% by weight.

4.1.1 Topsoil

Topsoil ranging from 20 mm to 250 mm in thickness was encountered within the project limits. Topsoil thickness will vary between and beyond boreholes.

4.1.2 Fill - Silty Clay

Silty clay fill material was encountered extending to depths ranging from 0.6 m to 2.4 m below ground surface. Laboratory test results (grain size analysis and Atterberg Limits tests) of samples of this fill material are illustrated in Figures B2 and B3, Appendix B.

Standard Penetration Tests conducted in this fill material gave "N" values ranging from 8 to 28 blows for 0.3 m penetration and pocket penetrometer tests on relatively undisturbed samples gave undrained shear strengths ranging from 150 kPa to 175 kPa. Based on these results the fill is considered to have a stiff to very stiff consistency. The moisture content of samples of this fill ranged from 7% to 33% by weight.

4.1.3 Fill - Sand and Silt

Sand and silt fill was encountered in Borehole 14 extending to a depth of 1.2 m below ground surface. The grain size distribution curve of a sample of this soil is illustrated in Figure B4, Appendix B. The moisture content of a sample of the fill was 9% by weight.

4.1.4 Fill - Sand and Gravel

Granular fill material ranging from sand, to sand and gravel was encountered within the project limits extending to depths ranging from 0.6 m to 3.7 m below ground surface. This fill is in a compact to very dense state based on SPT "N" values that ranged from 12 to 84 blows for 0.3 m penetration. The moisture content of samples of this fill ranged from 3% to 9% by weight.

4.1.5 Silty Clay to Clayey Silt Till

Silty clay to clayey silt till was encountered within the project limits extending to depths ranging from 1.3 m to 2.4 m in the shallow pavement boreholes and to a termination depth of 9.6 m in Borehole 10-5. Till soils can be expected to contain cobbles and boulders. Laboratory test results (grain size analysis and Atterberg Limits tests) of samples of the silty clay to clayey silt till are presented in Figures B5 and B6 respectively, Appendix B.

Standard Penetration tests performed in this deposit yielded "N" values ranging from 6 to more than 50 blows for 0.3 m penetration and pocket penetrometer tests conducted on relatively undisturbed samples of this deposit gave undrained shear strengths ranging from 135 kPa to more than 225 kPa. Based on these results

the silty clay to clayey silt till is considered to have a generally stiff to hard consistency with occasional firm zones. The moisture content of samples of the till ranged from 6% to 20% by weight.

4.1.6 Sands & Silts

Deposits of sands and silts were encountered in some of the boreholes. These deposits extend to depths ranging from 1.5 m to 1.8 m below ground surface. Refer to Figure B7, Appendix B for the grain size distribution curves of samples from these deposits.

A Standard Penetration test performed in this deposit yielded an "N" value of 47 blows for 0.3 m penetration indicating a dense relative density. The moisture content of samples of the soils ranged from 10% to 19% by weight.

4.2 Culvert Site (Sta. 7+900)

Borehole 34 was extended at this site and encountered a 200 mm thick surficial layer of topsoil. Topsoil thickness will vary beyond and between boreholes.

The topsoil is underlain by a layer of silty clay fill that extends to a depth of 2.9 m below ground surface. The silty clay fill is considered to have a stiff to very stiff consistency based on SPT "N" values that ranged from 8 blows to 19 blows for 0.3 m penetration. The moisture content of samples of this fill ranged from 13% to 17% by weight.

The silty clay fill is further underlain by a native deposit of sand and silt till that extends to a depth of 6.9 m below ground surface. The grain size distribution curve of a sample of this till is illustrated in Figure B8, Appendix B. Random cobble and boulder inclusions can also be expected to occur in till soils.

The sand and silt till is considered to have a very dense relative density based on SPT "N" values that ranged from 58 blows to more than 50 blows for 0.3 m penetration. The moisture content of samples of the sand and silt till ranged from 6% to 14% by weight.

At this site a native deposit of sand and gravel was encountered extending to the borehole termination depth (7.7 m). A Standard Penetration test conducted in this sand and gravel deposit gave an "N" value of more than 50 blows for 0.3 m penetration indicating a very dense relative density. The moisture content of a sample of this soil was 7% by weight.

4.3 Culvert Site (Sta. 16+420)

Borehole 10-5 was extended through the existing pavement at this site and encountered a 125 mm thick layer of asphalt.

The asphalt is underlain by sand and gravel fill that extends to a depth of 3.7 m below ground surface. This fill is considered to have a compact to very dense relative density based on SPT "N" values that ranged from 17 blows to in excess of 50 blows for 0.3 m penetration. The moisture content of samples of this fill ranged from 4% to 6% by weight.

At this site the sand and gravel fill is further underlain by a native deposit of silty clay to clayey silt till that extends to a borehole termination depth of 9.6 m and possibly beyond. The grain size distribution curve of samples of this till are illustrated in Figure B5 and the results of an Atterberg Limits test are plotted on the plasticity chart Figure B6, Appendix B. Random cobble and boulder inclusions can also be expected to occur in till soils.

The silty clay till is generally considered to have a firm to hard consistency based on SPT "N" values that ranged from 6 blows to more than 68 blows for 0.3 m penetration. The moisture content of samples of the silty clay to clayey silt till ranged from 10% to 20% by weight.

4.4 Water Levels

Water level observations were made in each borehole during and after completion of drilling. All of the shallow pavement boreholes were open and dry after drilling was complete. A wet cave was experienced in Borehole 10-5 at a depth of 3.7 m upon completion of drilling.

Borehole 34 was instrumented with a standpipe piezometer and water level measurements were made on separate visits after the field investigation. The water level readings are presented in the following table.

Water Levels

Location	Borehole	Date	Water Levels	
			Depth (m)	Elevation (m)
Culvert Site at Sta. 7+900	34	November 19, 2008 December 01, 2008	2.7 2.6	215.0 215.1

Based on these observations, it is our opinion that the ground water level at the culvert site (Sta. 7+900) is estimated to be at Elev. ± 215 m. The ground water level at the culvert site (Sta. 16+420) is estimated to be approximately ± 3.5 m below ground surface based on our review of the moisture content of the retrieved samples.

Perched water can also be expected to occur where relatively permeable layers of soil are underlain by more impermeable clayey silt and silty clay layers. The ground water level is subject to seasonal variations and will also be influenced by the free water level in the watercourses as well as by weather events.

5. DISCUSSION AND RECOMMENDATIONS

5.1 General

The following preliminary discussion and recommendations are based on the data obtained from this investigation and are intended for use by the owner and the design engineer. Further investigations will be required to support detail design.

This report is provided based on the terms of reference and on the assumption that the design features relevant to the geotechnical analyses will be in accordance with applicable codes, standards and guidelines of practice. If there are any changes to the site development features, or there is any additional information relevant to the interpretations made of the subsurface information with respect to the geotechnical analyses or other recommendations, then Terraprobe should be retained to review the implications of these changes with respect to the contents of this report.

5.2 Foundations

5.2.1 Culverts At Sta. 7+900 and Sta. 16+420

Spread footings are the most feasible and practical alternative for supporting a culvert extension or replacement. The recommended founding depths and geotechnical resistances for spread footings founded on undisturbed competent natural soils at the two culvert sites are tabulated below.

Geotechnical Resistances at Borehole Location (Culvert at Sta. 7+900)

BH No.	Existing Ground Surface Elev. (m)	Highest (Bottom) of Footing Below Existing Ground Surface (m)	Highest (Bottom) of Footing Elevation (m)	Factored Geotechnical Resistance at U.L.S. (kPa)	Bearing Resistance at S.L.S. (kPa)	Subgrade Material
34	217.7	2.9	214.8	500	325	Sand and Silt Till *

* Subgrade soils will be easily disturbed when wet. Working mat/skim coat of lean concrete to be poured on subgrade soils after inspection and approval by the geotechnical engineer.

Geotechnical Resistances at Borehole Location (Culvert at Sta. 16+420)

BH No.	Existing Ground Surface Elev. (m)	Highest (Bottom) of Footing Below Existing Ground Surface (m)	Highest (Bottom) of Footing Elevation (m)	Factored Geotechnical Resistance at U.L.S. (kPa)	Bearing Resistance at S.L.S. (kPa)	Subgrade Material
10-5	101.1*	4.6	96.5*	375	250	Silty Clay to Clayey Silt Till **

* Elevations based on temporary benchmark (Elev.=100.00m) established on top north east corner of the existing culvert.
** Working mat/skim coat of lean concrete to be poured on subgrade soils after inspection and approval by the geotechnical engineer.

The geotechnical resistances quoted in the preceding table are for concentric, vertical loads only. For eccentric or inclined loading, the geotechnical resistance must be reduced as illustrated in the CHBDC Clause 6.7.3 and Clause 6.7.4. The SLS value quoted in the table corresponds to a settlement of up to 20 mm assuming that the founding soils will be undisturbed during construction.

The sliding resistance of mass concrete poured on the sand and silt till subgrade may be computed based on an ultimate coefficient of friction of 0.7. The sliding resistance of mass concrete poured on the silty clay to clayey silt subgrade may be computed based on an ultimate coefficient of friction of 0.5.

Passive earth pressure resistance is generally not considered as a resisting force against sliding for conventional structure design because a structure must deflect significantly to develop the full passive resistance.

Design frost protection for the general area is 1.2 m. Therefore a permanent soil cover of 1.2 m or its thermal equivalent is required for frost protection of foundations. Where rip-rap (rock fill) is used only one-half of the rock fill thickness should be assumed to be effective in providing frost protection.

A working mat or skim coat of lean concrete is required on all footing bases. Prior to placing foundation concrete, the foundation base must be cleaned of all deleterious materials such as organics, topsoil, fill, softened, disturbed or caved materials, and any standing water. If construction proceeds during freezing weather conditions, adequate temporary frost protection for the founding subgrade and concrete must be provided.

5.2.2 Backfilling and Lateral Earth Pressures

Earth pressures acting on the structure should be computed in accordance with Clause 6.9 of the CHBDC but generally is given by the expression:

$$P = K[\gamma (h-h_w) + \gamma' h_w + q] + \gamma_w h_w$$

- P = the horizontal pressure at depth, **h** (m),
- h = depth to point of interest (m),
- K = the earth pressure coefficient,
- h_w = the depth below the ground water level (m),
- γ = the bulk unit weight of soil, (kN/m^3),
- γ' = the submerged unit weight of soil, (i.e. γ - 9.8 kN/m^3),
- q = the complete surcharge loading (kPa).

Where drainage can be provided effectively to eliminate hydrostatic pressures on the wall acting in conjunction with the earth pressure, this equation can be simplified to:

$$P = K(\gamma h + q)$$

The backfill to the culvert should be in accordance with OPSS 902 and granular backfill should be placed to the extents shown in OPSD 803.010 (concrete culvert). All granular backfill must meet the specifications of OPSS 1010.

Backfill behind culverts should consist of free draining granular materials. For fills below the groundwater level or immediately below the roadway, it is recommended that Granular A material be used. Where necessary, proper tapering should be provided. Free draining backfill material, weepholes, etc. should be provided in order to prevent hydrostatic pressures, as shown on OPSD 3101.150.

In accordance with Clause 6.9.3 of the CHBDC, a compaction surcharge should be added. The magnitude should be 12 kPa at the top of the fill decreasing to 0 kPa at a depth of 1.7 m for Granular B Type I or to a depth of 2.0 m for Granular A or Granular B Type II.

Compaction equipment to be used adjacent to retaining structures should be restricted in accordance with OPSS 501.06. The backfilling operation should be carried out simultaneously on both sides of the culvert and should be carried out in accordance with OPSS 902.

Earth pressure coefficients for backfill to the culverts and wing walls are dependent on the material used as backfill. Typical values are tabulated below.

Earth Pressure Coefficients

Wall Condition	Earth Pressure Coefficient (K)			
	OPSS Granular A or OPSS Granular B Type II $\phi = 35°$; $\gamma = 22.8$ kN/m^3		OPSS Granular B Type I $\phi = 32°$; $\gamma = 21.2$ kN/m^3	
	Horizontal Surface Behind Wall	Sloping Surface Behind Wall (2H:1V)	Horizontal Surface Behind Wall	Sloping Surface Behind Wall (2H:1V)
Active (Unrestrained Wall)	0.27	0.40*	0.30	0.48*
At rest (Restrained Wall)	0.43	-	0.47	-

* For Wing Walls

The factors in the table above are "ultimate" values and require certain movements for the respective conditions to be mobilized. The values to use in design can be estimated from Figure C6.9.1 (a) in the Commentary to the CHBDC, 2006.

5.2.3 Temporary Shoring Design

Temporary shoring may be required at the culvert sites and the shoring must be designed in accordance with Ontario regulations by a Professional Engineer experienced in this type of work. Shoring should be designed so that the lateral movement of any portion of the roadway protection system will not exceed the established criterion for the structure performance level. Performance Level 2, 25 mm maximum horizontal displacement is recommended.

The appropriate unfactored parameters to be used for temporary shoring design are tabulated below.

Culvert at Sta. 7+900					
Soil	**ϕ**	**γ**	**K_a**	**K_o**	**K_p**
Fill - Silty Clay	30	18	0.33	0.5	3.0
Sand and Silt Till	35	20	0.27	0.4	3.7
Sand and Gravel	35	19	0.27	0.4	3.7

Culvert at Sta. 16+420					
Soil	**ϕ**	**γ**	**K_a**	**K_o**	**K_p**
Fill - Sand and Gravel	30	19	0.33	0.5	3.0
Silty Clay to Clayey Silt Till	32	20	0.30	0.47	3.3

5.2.4 Excavations & Groundwater Control

Excavations must be carried out in accordance with the Occupational Health and Safety Act and Regulations for Construction Projects. Excavations at the culvert sites will be made through silty clay fill, sand and gravel fill, sand and silt till and silty clay to clayey silt till. These soils can be classified as follows:

- Fill material - Type 3 soils above the water table and Type 4 soils below the water table.
- Sand and Silt Till - Type 2 soil above the water table and Type 3 soil below the water table.
- Silty Clay to Clayey Silt Till - Type 2 soil above the water table and Type 3 soil below the water table.

Where workers must enter excavations extending deeper than 1.2 m, the trench walls must be suitably sloped and/or braced in accordance with the Occupational Health and Safety Act and Regulations for Construction Projects.

The dewatering effort can be expected to increase with depth especially at the first culvert site (Sta. 7+900) where sand and silt till soils were encountered. Therefore, the depth of excavation should be minimized as much as possible. A suitable system that might be employed can include gravity drainage and pumping from strategically placed filtered sumps. The design of the unwatering system should be the Contractor's responsibility.

5.2.5 Erosion Protection

Erosion protection should be provided at the culvert inlet and outlet (including the slopes and sides). At the inlet area this could consist of a clay seal. The purpose of the clay seal is to ensure that water flow is channelled through the culvert and does not seep through the backfill around and underneath the structure. It should be ensured that the clay seal extends to cover all the granular backfill materials to prevent seepage through them. The clay seal should therefore be continuous and have a minimum compacted thickness of 0.6 m and should extend above the high water level. The clay seal should be protected by a layer of rip-rap. The material used for the clay seal should conform to the requirements stipulated in OPSS 1205.

Alternatively, concrete cut-off and head walls can be constructed to protect the granular backfill and prevent seepage around the culvert. Concrete cut-off and head walls can also be used to protect the granular fill around the culvert outlet against erosion. In this case, however, filtered erosion protection such as rip-rap should be provided along the channel and the sides beyond the concrete cut-off and head walls at the outlet.

Design of erosion protection schemes for the stream bed in the inlet and outlet areas will depend on hydrologic, hydraulic and/or other concerns. Typically, rip-rap protection should be provided to these areas. The rip-rap layer should cover all surfaces on the embankment slopes with which creek water is likely to be in contact.

All footings must be placed below the predicted scour depth i.e. 1.5 m below the river bed level for preliminary design purposes. This preliminary scour depth must be verified by a river engineer.

5.3 Pavement Condition

A visual pavement condition survey of Dixie Road from Queen Street to Mayfield Road was undertaken in May 2009. The pavement condition survey from Mayfield Road to 2.1 km north of Mayfield Road was conducted in August 2010. The survey was conducted in accordance with the procedures outlined in MTO's manual for Flexible Pavement Condition Rating - Guidelines for Municipalities (SP-022).

The pavement distress features noted for the evaluated pavement sections are summarized in the following table. The Pavement Condition Evaluation Forms are included in Appendix C.

Section	Overall Condition	General Distresses
Dixie Road Sta. 7+800 to Sta. 8+300	PCR = 70, RCR = 7 Good	• Intermittent slight potholes. • Intermittent slight distortion and utility trenches. • Frequent moderate longitudinal and transverse cracks. • Frequent severe pavement edge breaks. • Frequent slight map cracking. • Intermittent moderate alligator cracking.
Dixie Road Sta. 8+300 to Sta. 9+500	PCR = 80, RCR = 8 Good	• Intermittent slight distortion and utility trenches. • Intermittent slight longitudinal and transverse cracks. • Intermittent slight pavement edge breaks and map cracking.
Dixie Road Sta. 9+500 to Sta. 9+900	PCR = 75, RCR = 7 Good	• Intermittent moderate potholes. • Intermittent slight to moderate pavement edge breaks • Intermittent slight distortion • Frequent moderate longitudinal cracks • Intermittent slight transverse cracks • Intermittent slight map cracking.
Dixie Road Sta. 9+900 to Sta. 10+700	PCR = 75, RCR = 7 Good	• Intermittent slight potholes. • Intermittent slight rippling and shoving and distortion. • Frequent moderate longitudinal cracks. • Intermittent slight pavement edge breaks, transverse and map cracking.
Dixie Road Sta. 10+700 to Sta. 13+750	PCR = 85, RCR = 8 Good	• Intermittent slight potholes. • Intermittent slight distortion, longitudinal and transverse cracks.
Dixie Road Sta. 13+750 to Sta. 15+000	PCR = 80, RCR = 8 Good	• Intermittent slight ravelling, potholes and pavement edge breaks. • Intermittent slight transverse cracks, pavement edge breaks and map cracking. • Frequent slight longitudinal cracks.
Dixie Road Sta. 15+000 to Sta. 17+064	PCR = 90, RCR = 9 Excellent	• Intermittent slight ravelling. • Moderate distortion at Sta. 15+900 and Sta. 16+275 above existing CSP's.

5.4 Traffic Volumes and Pavement Design Parameters

The AADT values, annual growth rates and percentage of commercial vehicles used for the pavement design were provided by AECOM. This data is summarized as follows:

Pavement Design Parameters	DIXIE ROAD
	Sta. 7+800 to Sta. 17+064
AADT (2008)	22,778
Projected Base Year AADT (2010)	24,400
Projected AADT (Year 2025)	40,880
Annual Growth Rate (2008 to 2025)	3.5%
Percent Commercial Vehicles	5%
Directional Split	50%

The following references and guidelines were used for the pavement designs.

- MTO's "Adaptation and Verification of AASHTO Pavement Design Guide for Ontario Conditions," MI-183, March 2008.
- AASHTO Guide for the Design of Pavement Structures, 1993.
- "Procedures for Estimating Traffic Loads for Pavement Designs," Hajek J., 1995.

The pavements were designed using AASHTOWare DARWIN 3.1, a proprietary pavement design software. The AASHTO pavement design parameters used for conducting the pavement thickness designs are tabulated as follows:

INPUT PARAMETER	DESIGN REQUIREMENT
Initial/Terminal Serviceability Index	p_i = 4.2 p_t = 2.2
Design Period (years)	15
Cumulative ESAL's	6,363,500
Reliability and Standard Deviation	R = 85% SD = 0.44
Estimated Elastic Modulus for Subgrade (kPa)	30,000 to 35,000
Layer Coefficients of Hot Mix Asphalt (HMA)	New HMA = 0.42 Existing HMA = 0.28
Layer Coefficients of Granular Material	Gran A = 0.14 Gran B Type I = 0.09 Existing Granular = 0.09
Drainage Coefficient	m = 1 (new granular base & subbase) m = 1 (existing granular material)

5.5 Pavement Structure

Based on the estimated traffic loads acting over a 15 year design period, the recommended pavement structure for new construction is:

Hot mix asphalt	DFC	50 mm
	HDBC	100 mm (two 50 mm lifts)
Granular A Base Course		150 mm
Granular B Type I Subbase		500 mm
Total thickness		800 mm
Structural Number		129 mm
Granular Base Equivalency		783 mm

The pavement widening should be undertaken as outlined below:

- Saw cut existing edge of pavement and excavate shoulders to the design subgrade elevation then place and compact 500 mm of Granular B Type I subbase.
- Continuity of drainage should be maintained between existing and new pavement structures. In this regard the granular thickness in the widened area may have to be increased from the recommended thickness is some areas to match granular fill under the existing pavement.
- Place and compact 150 mm of Granular A base course.
- Pave with 50 mm DFC and 100 mm HDBC.

The structural capacity of the existing roadway (Dixie Road) was assessed for the design traffic. Rehabilitation design was considered for a service life extension of 15 years and a structural number of 123 mm is required to support the 15 year design traffic of 6,363,500 ESAL's. The effective structural number of the existing pavement is 92 mm indicating that pavement strengthening is required to meet the design structural number (123 mm).

Given the need to minimize the grade raise as much as possible we consider milling and paving to be a feasible and practical option. For a mill and pave operation we recommend milling 60 mm HMA and repaving with 115 mm HMA consisting of 50 mm DFC and 65 mm HDBC. Other rehabilitation options such as cold in place pulverization will require a significantly larger grade raise (compared to a mill and pave operation) and this may not be practical. If a grade raise cannot be accommodated full depth reconstruction will be required.

For full depth reconstruction the existing pavement structure must be removed and reconstructed. The recommended pavement structure is

Hot mix asphalt	DFC	50 mm
	HDBC	100 mm (two 50 mm lifts)
Granular A Base Course		150 mm
Granular B Type I Subbase		500 mm
Total thickness		800 mm
Structural Number		129 mm
Granular Base Equivalency		783 mm

The recommended surface course, i.e., DFC is based on MTO's directive PHY-C-016. Alternatively, a Superpave 12.5FC2 surface course can be used in which case Superpave 19.0 is recommended as the binder course.

SS1 Tack Coat must be applied between all new lifts of hot mix asphalt.

5.6 Culvert Bedding, Cover and Backfill

Bedding for CSP and/or minor concrete pipe culverts should be in accordance with the OPSD 802 series. Granular A material is recommended for bedding and cover to minor culverts.

5.7 Other Design Features

5.7.1 OHSA Soil Type

Excavations must be carried out in accordance with the Occupational Health and Safety Act and Regulations for Construction Projects. Shallow excavations for pavement construction will encounter fill material consisting of silty clay, sand and silt and sand and gravel. Excavations will also encounter native deposits of silty clay to clayey silt till and sands and silts. For the purposes of the OHSA these soils can be classified as follows:

- Fill material - Type 3 soils above the water table and Type 4 soils below the water table.
- Silty Clay to Clayey Silt Till - Type 2 soil above the water table and Type 3 soil below the water table.
- Sands and Silts - Type 2 soil above the water table and Type 3 soil below the water table.

5.7.2 Frost Penetration & Frost Susceptibility

For design purposes assume a frost penetration depth of 1.2 m.

The frost susceptibilities of the various soils encountered within the project limits are outlined below.

- Silty Clay Fill - Low to Moderate susceptibility to frost heave.
- Sand and Silt Fill - Low susceptibility to frost heave.
- Silty Clay to Clayey Silt Till - Low susceptibility to frost heave.
- Sands and Silts - Moderate susceptibility to frost heave.

5.7.3 Stripping

For preliminary estimating purposes assume an average topsoil thickness of 195 mm in the widening areas. Full depth removal of the topsoil and any other deleterious material is required prior to constructing pavements in the widening areas.

5.7.4 Pavement Removals & Reuse of Existing Granular Fill

The average pavement thickness outlined in Section 4.1 of this report can be used for estimating asphalt removals on this project.

Samples of the granular fill comprising the pavement structure of the existing roadway were tested and compared with Granular A and Granular B Type II specifications. The results indicate that the granular material does not meet Granular A specifications and would therefore be unsuitable for this use. The material generally meets the Granular B Type II specifications and would be suitable for reuse as a Granular B material. Further testing will be required during detail design to confirm the suitability of this material

5.7.5 Padding

If conventional asphalt mixes (DFC and HDBC) are used, then HL3 Fine is recommended as padding. Superpave 9.5 hot mix asphalt is recommended as padding if Superpave mixes are used on this project.

5.7.6 Asphalt Cement Grade

OPSS 1101 recommends an increase in the high temperature range of Performance Graded Asphalt Cement by one grade in the upper 80 mm to 100 mm of hot mix. Based on this standard specification PG 64-28 is recommended for asphalt concrete mixes used on the surface course and upper binder course lifts. PG 58-28 asphalt cement is recommended for all other mixes. Mix design criteria should be in accordance with OPSS 1150.

5.7.7 Pavement Crossfall

The finished pavement surface should be adequately sloped (normally 2%) towards the sides to provide positive drainage. Continuity of drainage through the granular road base and subbase layers should be maintained between the pavement and shoulders. In this regard, the granular thickness of the shoulders may have to be increased from the above recommended thicknesses in some areas to match the thicker existing granular fill below the existing pavement.

5.7.8 Drainage

Where a rural cross-section is proposed, ditches are required to collect and remove excess surface water. In cut sections the ditch will be located adjacent to the roadway and the ditch invert must be at least 0.5 m below the top of the subgrade. For fill sections the ditch invert should extend at least 0.25 m below the base of the fill and should be separated at least 1.5 m horizontally from the toe of the fill. To promote drainage of the pavement structure, the base granulars must extend across the full width of the roadway and must daylight in the ditches.

Where an urban cross-section is proposed a continuous subdrain system designed to freely drain into catch basins will be required. The drainage system should conform to the appropriate OPS. Typical drainage details are illustrated in Figure 4.

5.7.9 Pavement Taper

At the limits of construction, appropriate tapering of pavement thickness to match the existing pavement structure should be implemented in accordance with OPSS or applicable Region of Peel practice.

5.7.10 Compaction of Base & Sub-Base Materials

All granular base and subbase materials should be placed in 150 mm lifts and compacted to 100% of Standard Proctor Maximum Dry Density (SPMDD) at ±2% of Optimum Moisture Content (OMC). Asphalt concrete should be placed and compacted in accordance with the appropriate OPSS or Region of Peel specifications.

6. DESIGN CONSIDERATIONS FOR CONSTRUCTIBILITY

6.1 Subgrade Preparation

The roadway improvements will involve widening of the existing roadway platform. All topsoil, organics, soft/loose and otherwise disturbed soils should be stripped from the subgrade areas. Immediately prior to placing the pavement granular courses, the exposed subgrade should be compacted and then proofrolled with a heavy rubber tired vehicle (such as a loaded gravel truck). The subgrade should be inspected for signs of rutting or displacement. Areas with rutting or displacement should be recompacted and retested or excavated and replaced with well-compacted and clean fill.

After the subgrade is prepared, fill may be placed as and where required. Embankment fill and fill placed in areas where unsuitable material is removed may consist of either granular fill or local inorganic soils provided that the placement moisture content is within ±2% of the Optimum Moisture Content (OMC). Fill should be placed and compacted in accordance with OPSS 501. The final 300 mm of the road subgrade should be compacted to 98% of Standard Proctor Maximum Dry Density (SPMDD) at ±2% of the OMC. Subgrade preparation and fill construction should not be done in the winter. The final subgrade surface should be sloped at least 3% to drain towards the side ditches.

At this site the clayey silt and silty clay soils are fine-grained soils that will become weakened when subjected to traffic when wet. If site work is carried out during periods of wet weather, then the subgrade will be easily disturbed. Sands and silts will also be easily disturbed when wet. Under inclement weather conditions an adequate granular working surface would be required to minimize disturbance and protect the integrity of the subgrade soils.

6.2 Earth Slopes

Topsoil should be stripped from the existing fill slopes prior to commencing widening. Fill and cut slopes should not be steeper than 2H:1V. Permanent cut and fill slopes and ditch slopes should be immediately vegetated after construction to minimize erosion.

6.3 Backfill

The fill material and the native silty clay to clayey silt till will generally be suitable for use as backfill materials. However, the clayey soils are not free draining, and will be difficult to handle and compact when wet. Soils that become wet may be difficult to compact and will require moisture conditioning prior to placement.

The sands and silts are considered to have a moderate frost susceptibility. Further assessment will be required during detail design to determine if these soils would be suitable for use as backfill.

Topsoil encountered at the site may be stockpiled and reused for landscaping purposes.

6.4 Soil Chemical Analysis

Four selected soil samples were submitted to AGAT Laboratories for chemical characterization with respect to general inorganic parameters including metals, pH, sulphate, sodium adsorption ratio (SAR) and electrical conductivity (EC). These are nominal parameters analysed when there are no indications of environmental impacts. The Certificate of Analysis for the chemical testing is included in Appendix D.

The analytical results were compared with the corresponding soil property use standards listed in Table 1 (All Other Types of Property Uses) and Table 3 (Industrial/Commercial/Community Property Use) of the Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act, March 09, 2004. It is anticipated that these results will be used to determine disposal options for excess soils generated during construction.

Comparison of the test results indicates that the metal concentrations were below the remediation concentrations stipulated in Tables 1 and 3. However, the SAR and chloride concentrations and electrical conductivity values exceed the guideline limits in the tested soil samples which likely reflect the impact of road salting operations. The SAR and chloride concentrations and electrical conductivity values are shown in the following table together with the corresponding Table 1 and Table 3 standards. It should be noted that there are no Table 3 standards for chloride.

Parameter	Sample Number and Location				MOE Table 1 Standard	MOE Table 3 Standard
	BH 1 0.0 - 0.6 m	BH 5 0.6 - 1.2 m	BH 9 0.0 - 0.6 m	BH 12 0.6 - 1.2 m		
Electrical Conductivity	2.72	0.71	1.2	1.33	0.47	1.4
SAR	44.6	11.4	15.3	3.52	1.0	12
Chloride	1710	313	567	778	58	NV

Debris or stained/odorous soils, which are encountered during excavation, should be segregated and re-evaluated for disposal or re-use as fill and may require additional analysis.

6.5 Quality Control

The requirements for fill placement on this project have been stipulated relative to Standard Proctor Maximum Dry Density as determined by ASTM D698. Insitu determinations of density during fill placement, by procedure Method B of ASTM D2922 are recommended to demonstrate that the specified soil density is achieved.

7. LIMITATIONS AND RISK

7.1 Procedures

This investigation has been carried out using investigation techniques and engineering analysis methods consistent with those ordinarily exercised by Terraprobe and other engineering practitioners, working under similar conditions and subject to the time, financial and physical constraints applicable to this project. The discussions and recommendations that have been presented are based on the factual data obtained by Terraprobe.

It must be recognized that there are special risks whenever engineering or related disciplines are applied to identify subsurface conditions. Even a comprehensive sampling and testing programme implemented in accordance with the most stringent level of care may fail to detect certain conditions. Terraprobe has assumed for the purposes of providing design parameters and advice, that the conditions that exist between sampling points are similar to those found at the sample locations. The conditions that Terraprobe has interpreted as existing between sampling points can differ from those that actually exist.

It may not be possible to drill a sufficient number of boreholes or sample and report them in a way that would provide all the subsurface information that could affect construction costs, techniques, equipment and scheduling. Further investigations will be required in order to undertake a detail design.

7.2 Changes In Site And Scope

It must also be recognized that the passage of time, natural occurrences, and direct or indirect human intervention at or near the site have the potential to alter subsurface conditions. Groundwater conditions are particularly susceptible to change as a result of seasonal variation and alterations in drainage conditions. The discussion and recommendations are based on the factual data obtained from preliminary investigations made by Terraprobe and are intended for use by the owner and its retained designers in the preliminary design phase of the project and further investigations will be required for detail design. If there are changes to the project scope and development features, the interpretations made of the subsurface information, the geotechnical design parameters and comments relating to constructibility issues and quality control may not be relevant or complete for the revised project. Terraprobe should be retained to review the implications of such changes with respect to the contents of this report

Terraprobe Inc.

for J. G. Muckle, P.Eng.
Senior Geotechnical Engineer, Associate

ENCLOSURES

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FIGURES

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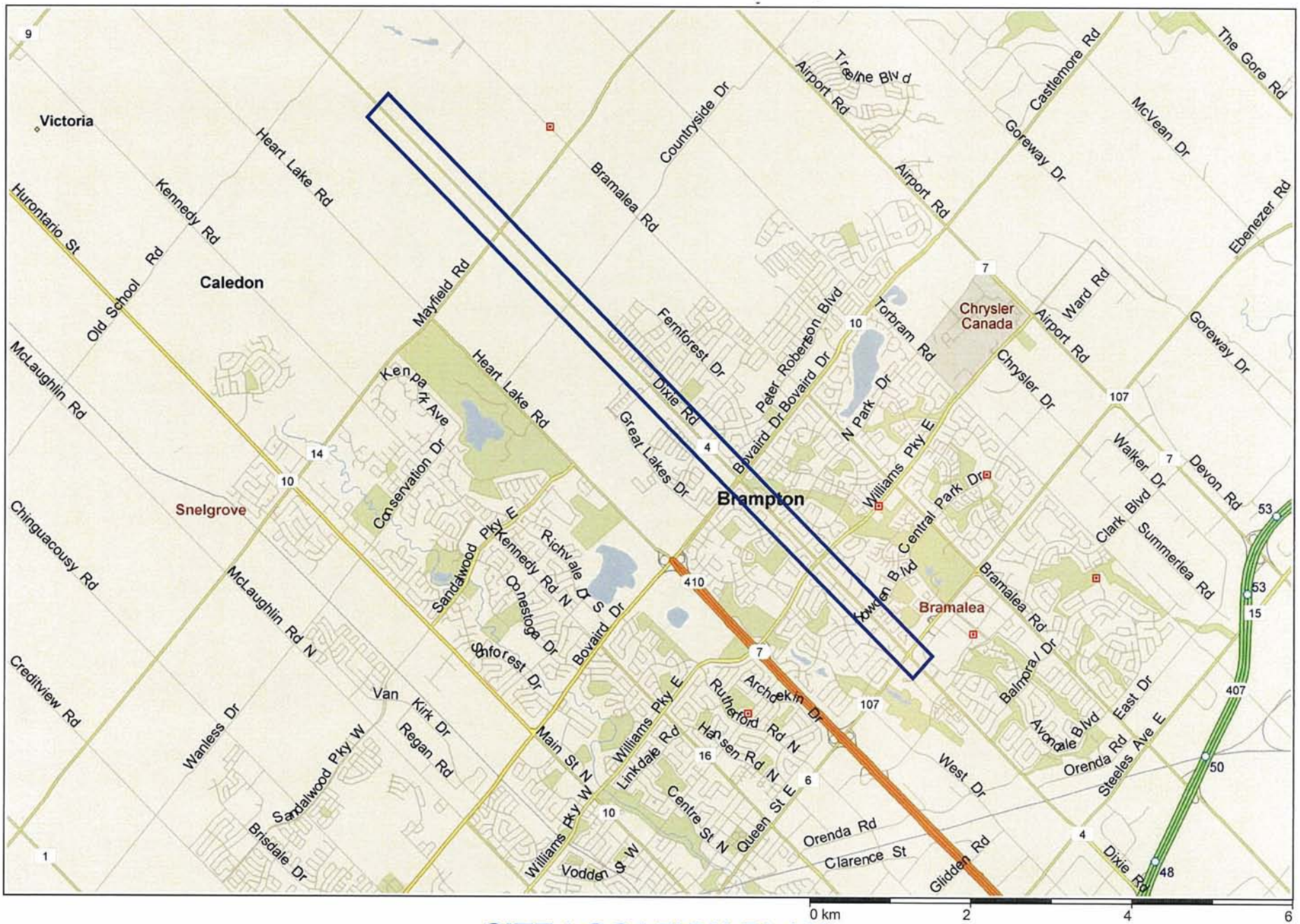
Dixie Road EA Study



SITE LOCATION PLAN

TERRAPROBE

File No. 1-10-5140

FIGURE 1

SITE PHOTOGRAPHS

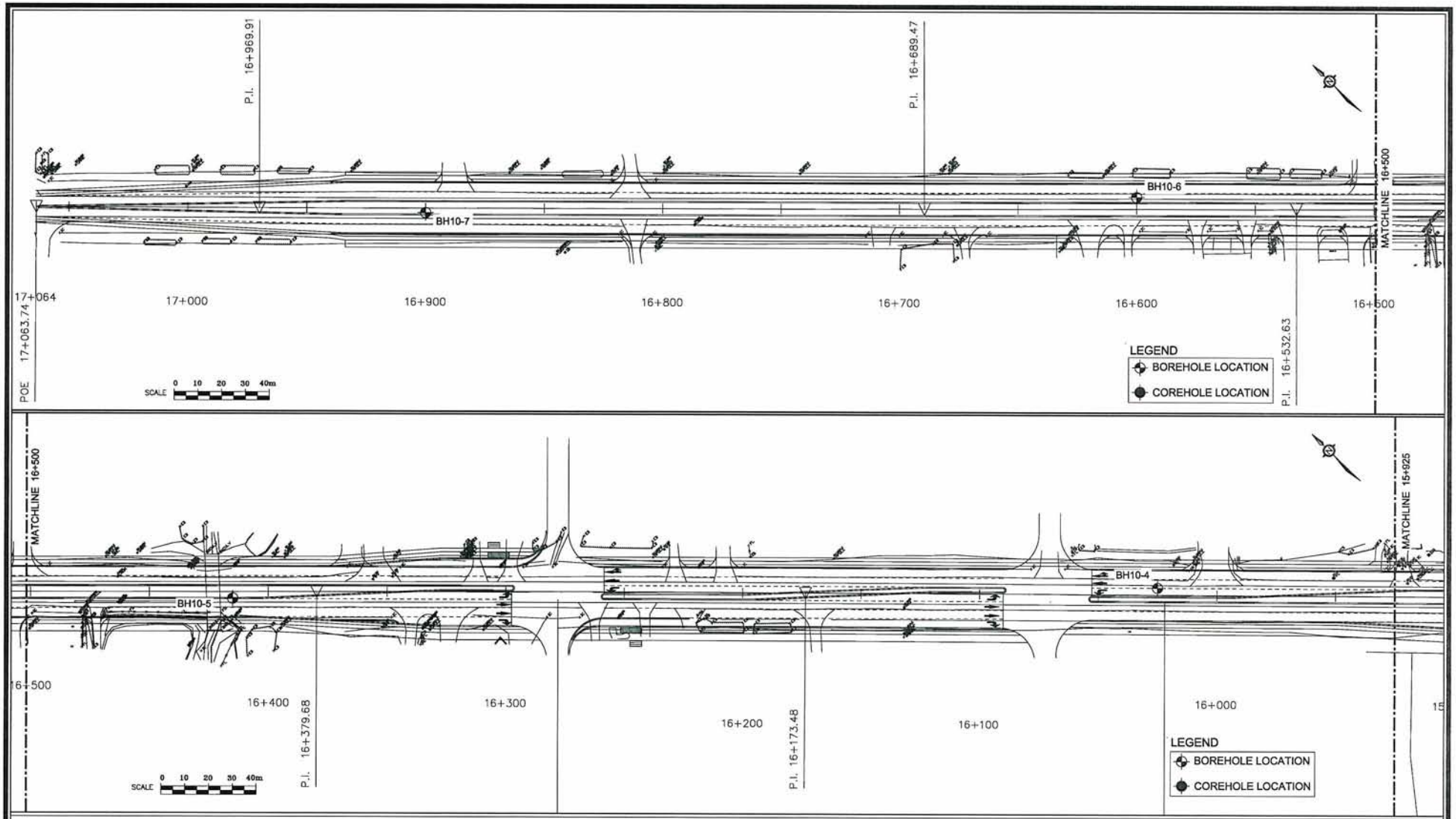
PHOTOGRAPH No.1 Sta. 13+050, Looking North.

PHOTOGRAPH No.2 Sta. 10+925, Looking South.

SITE PHOTOGRAPHS

PHOTOGRAPH No.3 Sta. 9+825, Looking South.

PHOTOGRAPH No.4 Sta. 8+200, Looking South.

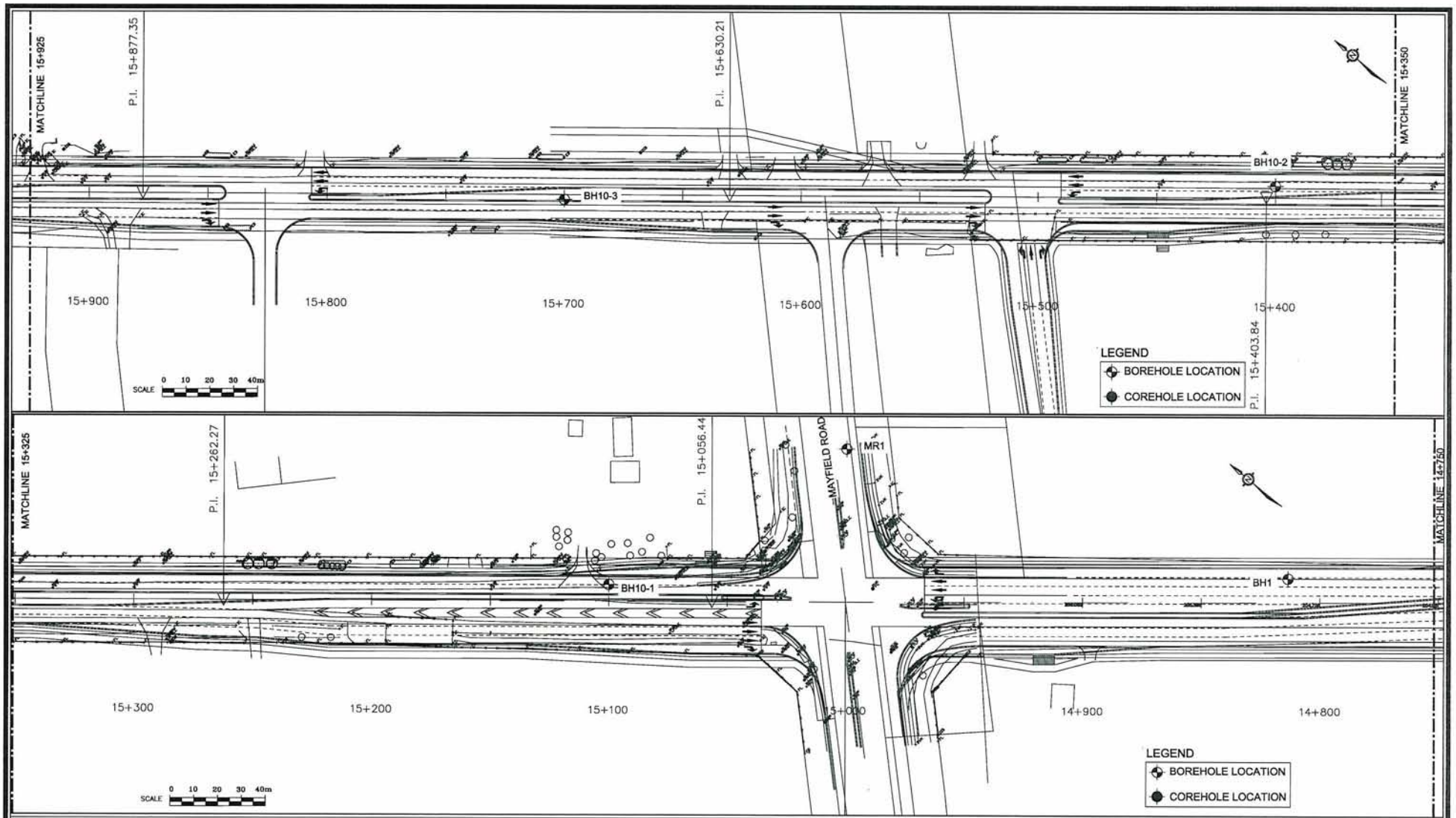


BOREHOLE LOCATION PLAN

TERRAPROBE INC.

File No. 1-10-5140

FIGURE 3A

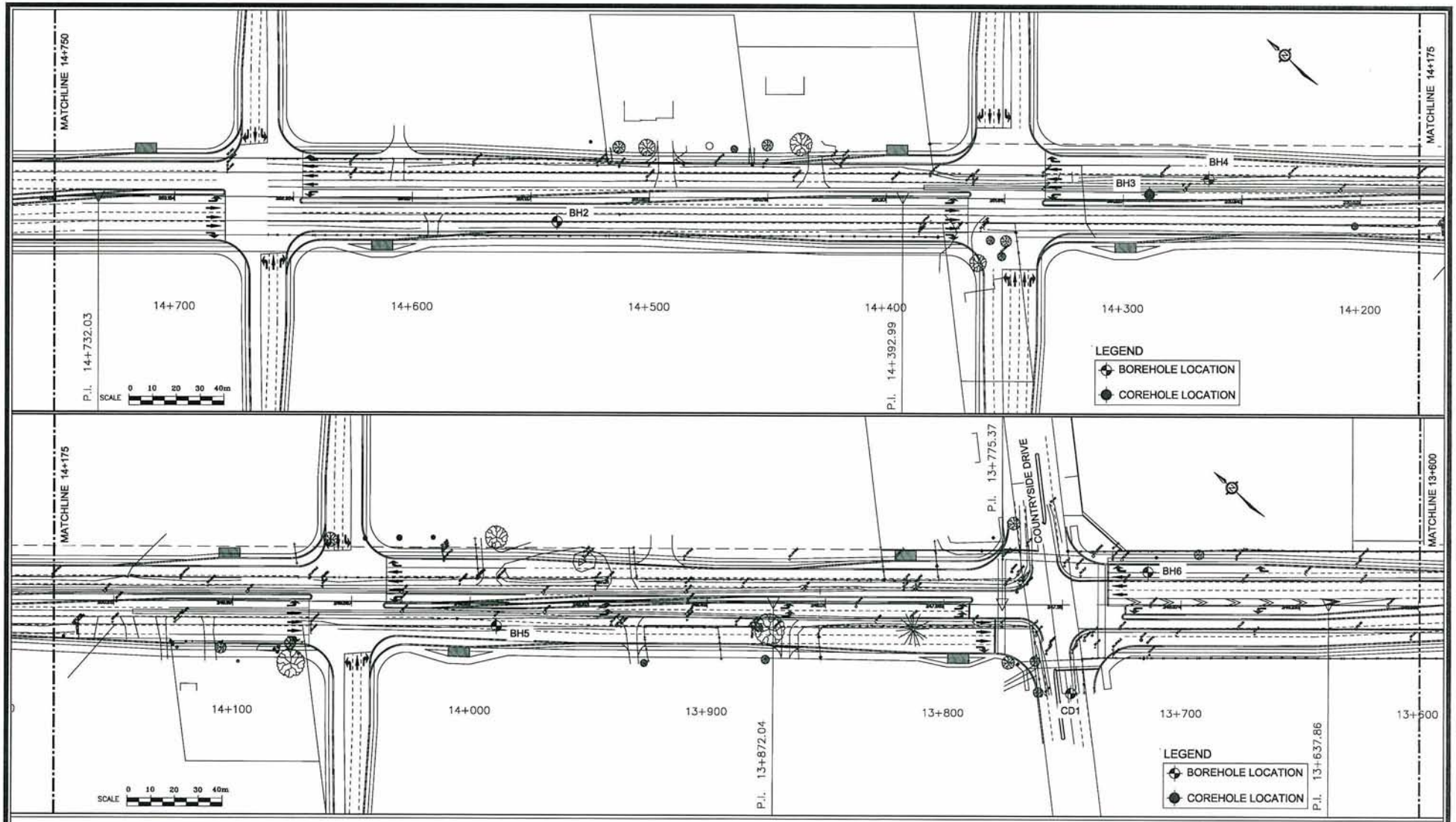


BOREHOLE LOCATION PLAN

TERRAPROBE INC.

File No. 1-10-5140

FIGURE 3B

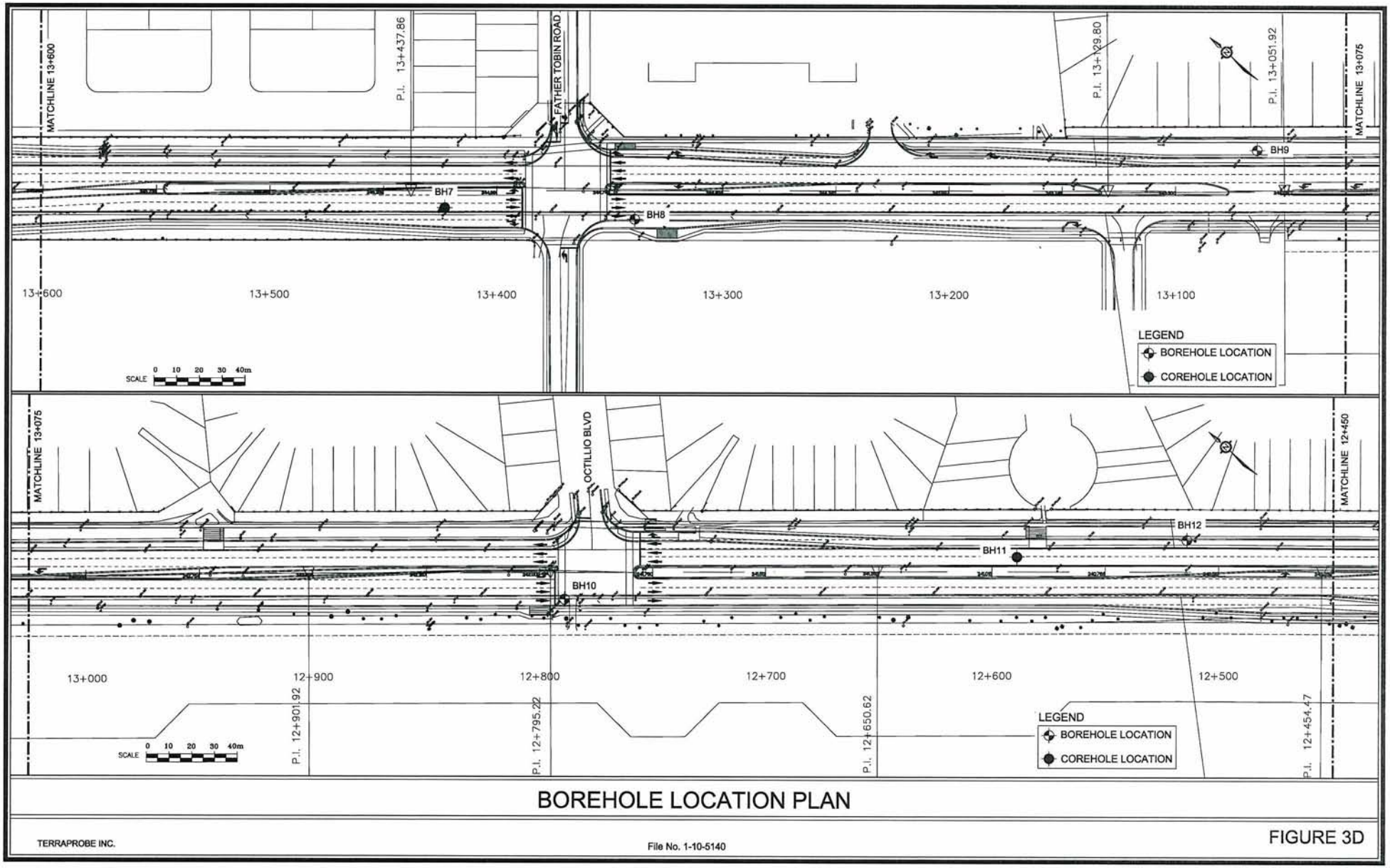


BOREHOLE LOCATION PLAN

TERRAPROBE INC.

File No. 1-10-5140

FIGURE 3C

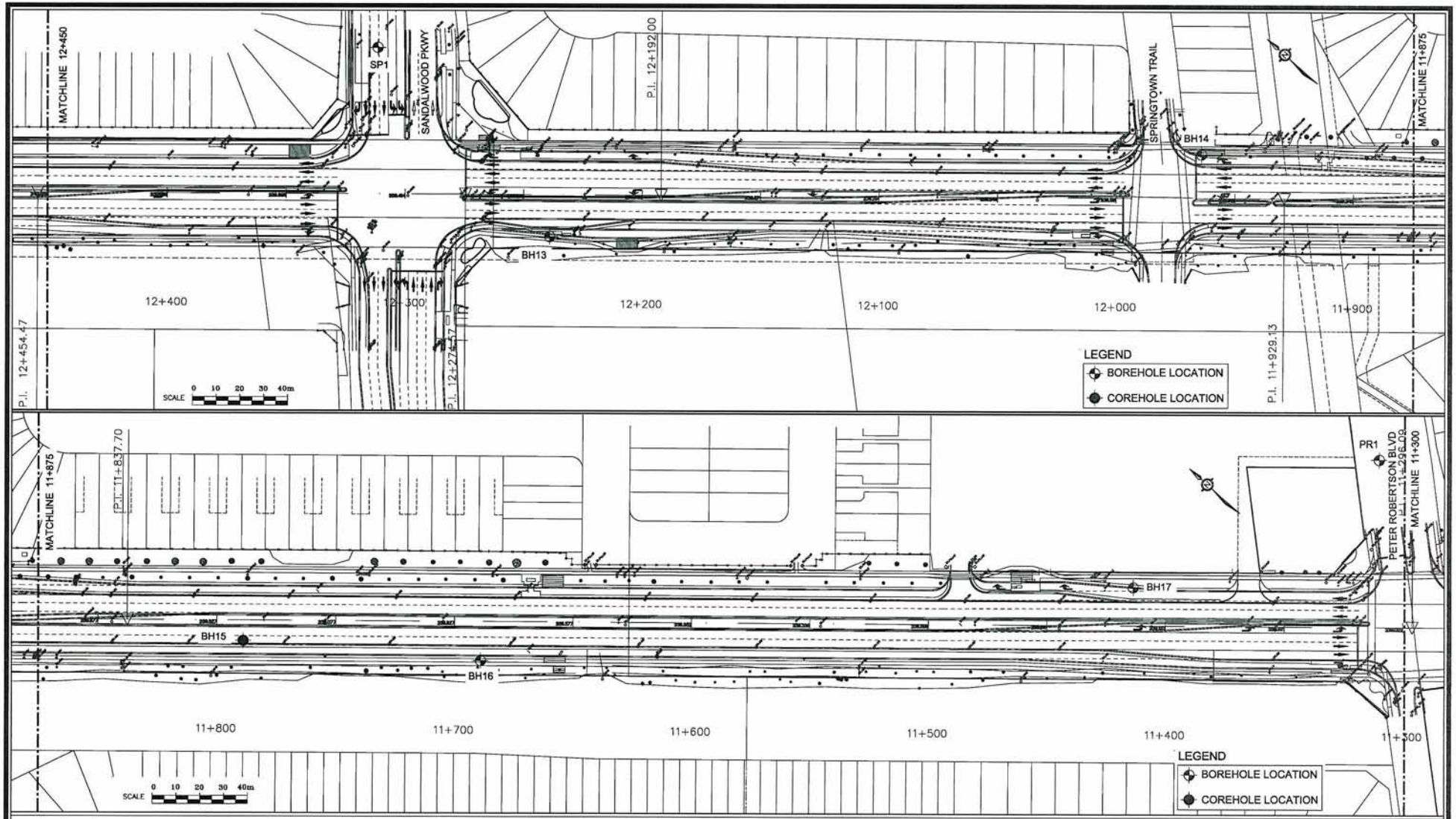


BOREHOLE LOCATION PLAN

TERRAPROBE INC.

File No. 1-10-5140

FIGURE 3D

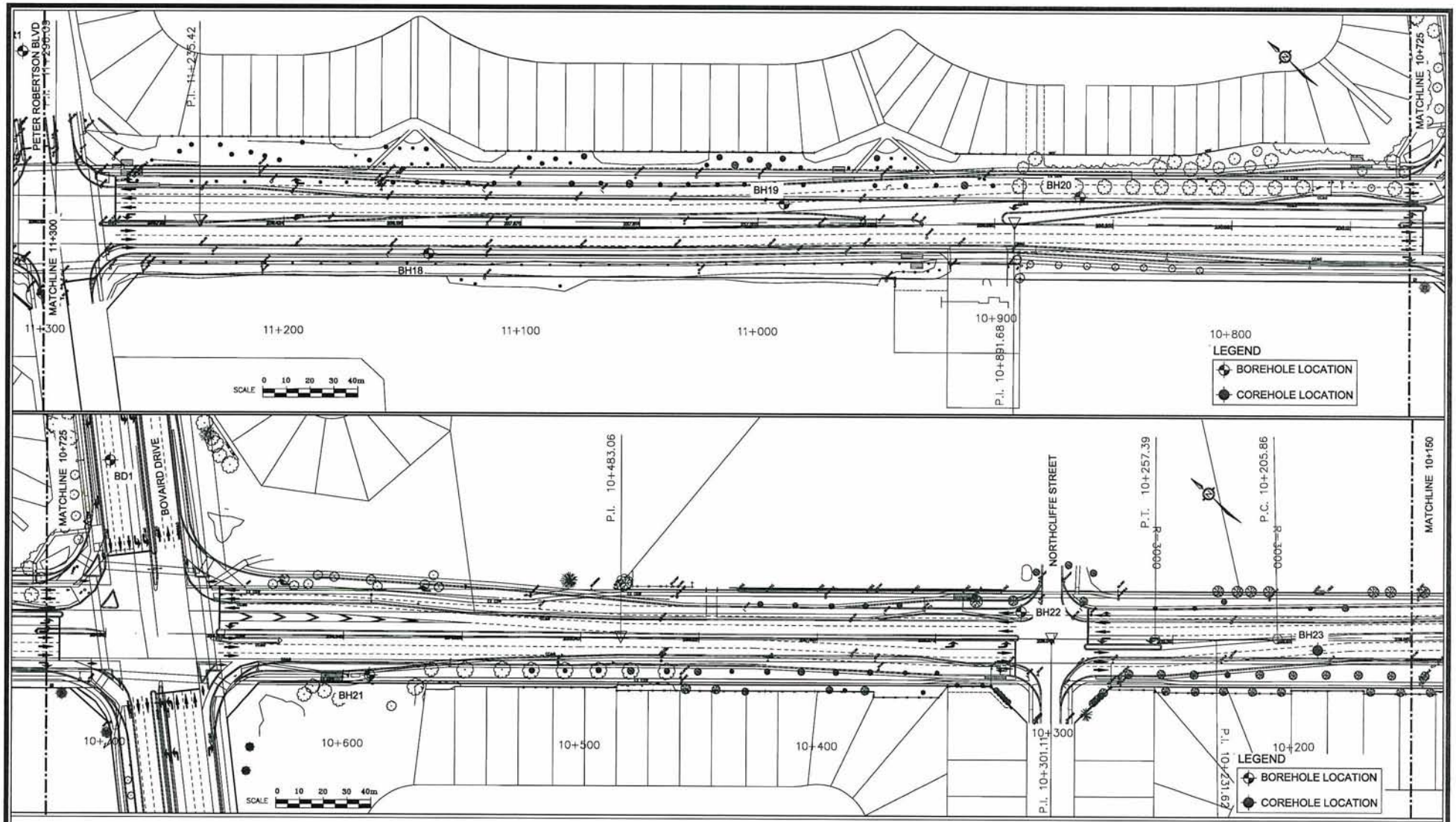


BOREHOLE LOCATION PLAN

TERRAPROBE INC.

File No. 1-10-5140

FIGURE 3E

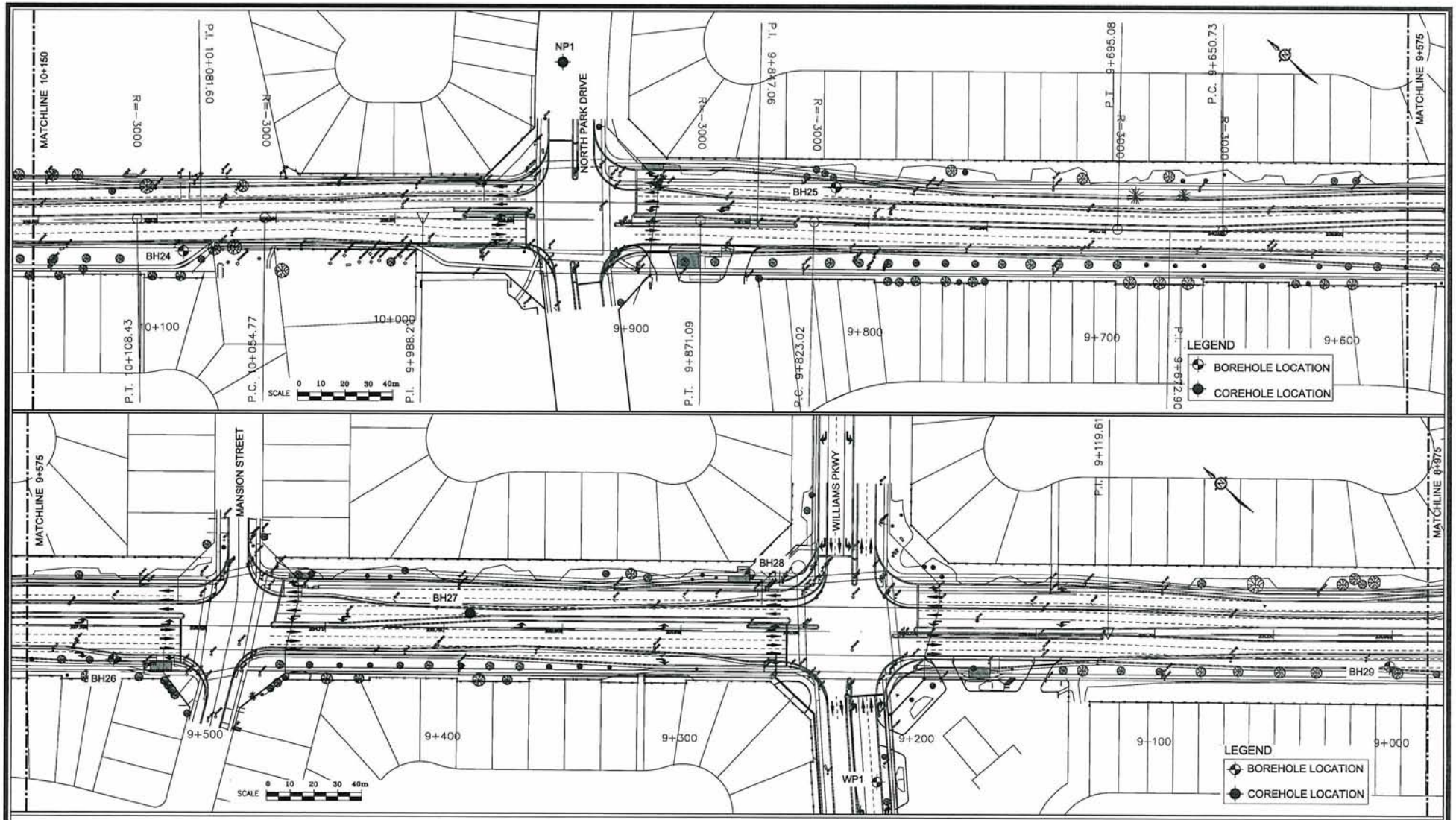


BOREHOLE LOCATION PLAN

TERRAPROBE INC.

File No. 1-10-5140

FIGURE 3F

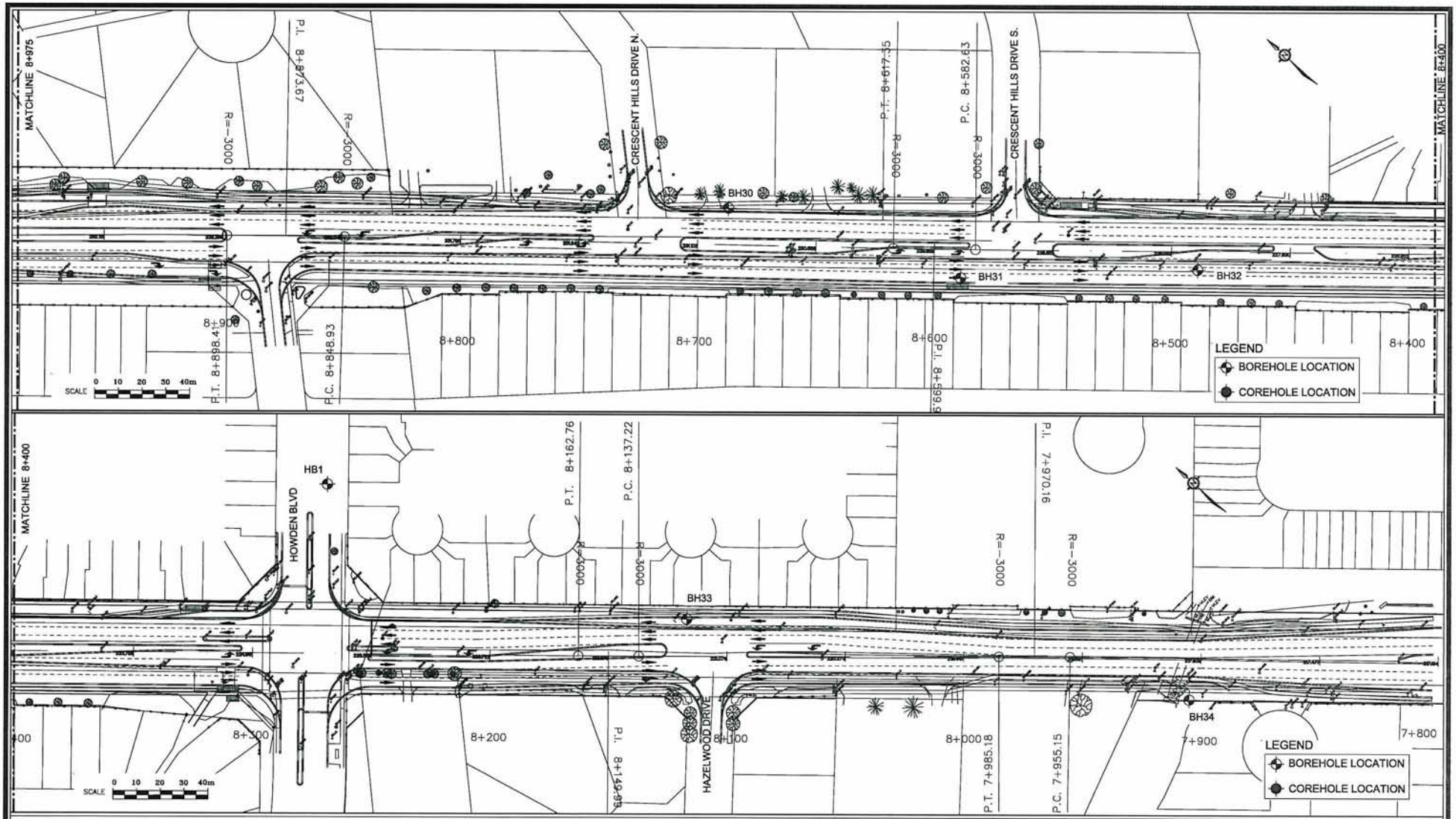


BOREHOLE LOCATION PLAN

TERRAPROBE INC.

File No. 1-10-5140

FIGURE 3G

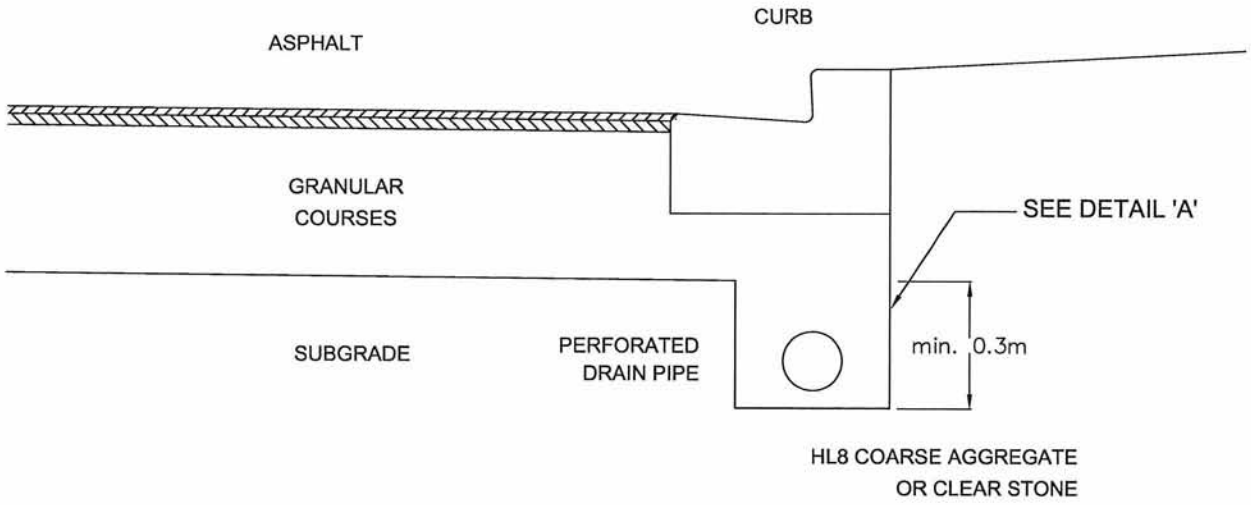


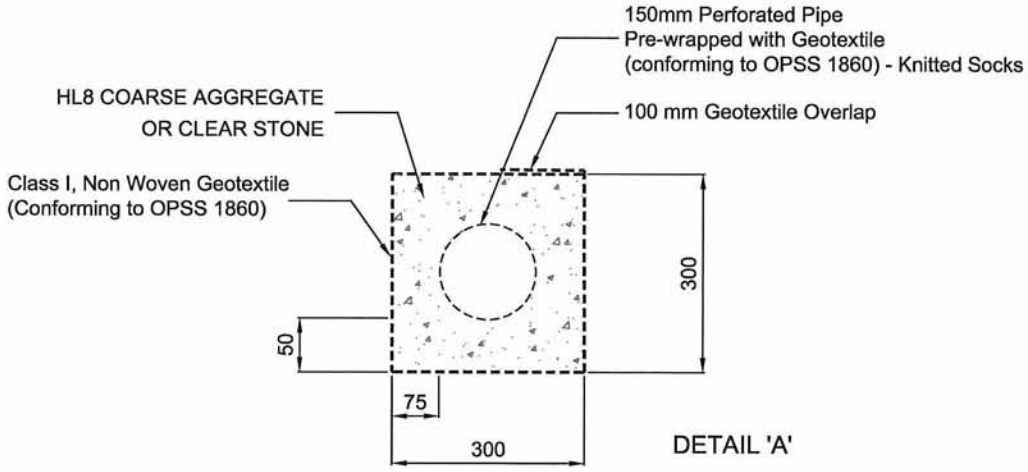
BOREHOLE LOCATION PLAN

TERRAPROBE INC.

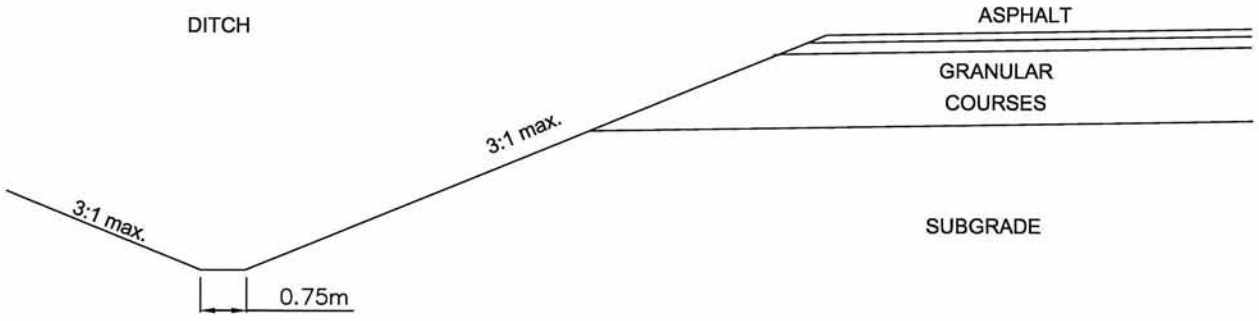
File No. 1-10-5140

FIGURE 3H





DETAIL 'A'



NOT TO SCALE

PAVEMENT DRAINAGE ALTERNATIVES

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File No. 1-10-5140

FIGURE 4

APPENDIX A

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ABBREVIATIONS, TERMINOLOGY, GENERAL INFORMATION

BOREHOLE LOGS

SAMPLING METHOD

SS	split spoon
ST	Shelby tube
AS	auger sample
WS	wash sample
RC	rock core
WH	weight of hammer
PH	pressure, hydraulic

PENETRATION RESISTANCE

Standard Penetration Test (SPT) resistance ('N' values) is defined as the number of blows by a hammer weighing 63.6 kg (140 lb.) falling freely for a distance of 0.76 m (30 in.) required to advance a standard 50 mm (2 in.) diameter split spoon sampler for a distance of 0.3 m (12 in.).

Dynamic Cone Test (DCT) resistance is defined as the number of blows by a hammer weighing 63.6 kg (140 lb.) falling freely for a distance of 0.76 m (30 in.) required to advance a conical steel point of 50 mm (2 in.) diameter and with 60° sides on 'A' size drill rods for a distance of 0.3 m (12 in.).

SOIL DESCRIPTION - COHESIONLESS SOILS

Relative Density	'N' value
very loose	< 4
loose	4 - 10
compact	10 - 30
dense	30 - 50
very dense	> 50

SOIL DESCRIPTION - COHESIVE SOILS

Consistency	Undrained Shear Strength, kPa	'N' value
very soft	< 12	< 2
soft	12 - 25	2 - 4
firm	25 - 50	4 - 8
stiff	50 - 100	8 - 15
very stiff	100 - 200	15 - 30
hard	> 200	> 30

SOIL COMPOSITION

	% by weight
'trace' (e.g. trace silt)	< 10
'some' (e.g. some gravel)	10 - 20
adjective (e.g. sandy)	20 - 35
'and' (e.g. sand and gravel)	35 - 50

TESTS, SYMBOLS

MH	mechanical sieve and hydrometer analysis
w, w_c	water content
w_l	liquid limit
w_p	plastic limit
I_p	plasticity index
k	coefficient of permeability
γ	soil unit weight, bulk
ϕ'	angle of internal friction
c'	cohesion shear strength
C_c	compression index

GENERAL INFORMATION, LIMITATIONS

The conclusions and recommendations provided in this report are based on the factual information obtained from the boreholes and/or test pits. Subsurface conditions between the test holes may vary.

The engineering interpretation and report recommendations are given only for the specific project detailed within, and only for the original client. Any third party decision, reliance, or use of this report is the sole and exclusive responsibility of such third party. The number and siting of boreholes and/or test pits may not be sufficient to determine all factors required for different purposes.

It is recommended Terraprobe be retained to review the project final design and to provide construction inspection and testing.

Terraprobe

LOG OF BOREHOLE 1

PROJECT: Dixie Road Improvements **COORDINATES:** _____ **DATE:** October 09, 2008

LOCATION: Brampton, Ontario **EQUIPMENT:** Solid Stem Augers

CLIENT: AECOM **ELEVATION DATUM:** n/a **FILE:** 1-10-5140

SOIL PROFILE			SAMPLES			ELEVATION SCALE	PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT	ORGANIC VAPOUR	STANDPIPE INSTALLATION OR REMARKS
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		20 40 60 80 100; ○ UNCONFINED + FIELD VANE; ● POCKET PEN. × LAB VANE	w_P w w_L; WATER CONTENT (%) 10 20 30	(ppm)	
0.0	Ground Surface									
	700mm FILL - Sand and Gravel, trace silt, dense, brown, dry		1	SS	38			○		
0.7	SILTY CLAY sandy, trace gravel, very stiff, brown, damp (GLACIAL TILL)		2	SS	22			○		
			3	SS	28		GR.SA.SI.CL 9 .29 .43.19	○		
1.8	End of Borehole									

NOTES:
Borehole was open and dry upon completion of drilling.

Terraprobe

LOG OF BOREHOLE 2

PROJECT: Dixie Road Improvements **COORDINATES:** _____ **DATE:** October 09, 2008

LOCATION: Brampton, Ontario **EQUIPMENT:** Solid Stem Augers

CLIENT: AECOM **ELEVATION DATUM:** n/a **FILE:** 1-10-5140

SOIL PROFILE			SAMPLES			ELEVATION SCALE	PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT	ORGANIC VAPOUR	STANDPIPE INSTALLATION OR REMARKS
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		20 40 60 80 100; ○ UNCONFINED + FIELD VANE; ● POCKET PEN. × LAB VANE	w_P w w_L; WATER CONTENT (%) 10 20 30	(ppm)	
0.0	Ground Surface									
	610mm FILL - Sand and Gravel, trace silt, dense, brown, damp		1	SS	31					
0.6	FILL - Silty Clay, trace sand, trace gravel, trace organics,									
0.8	very stiff, brown, damp		2	SS	20					
	SILTY CLAY some sand, trace gravel, occasional sand seams, very stiff to hard, brown									
	(GLACIAL TILL)		3	SS	37					
1.8	End of Borehole									

NOTES:
Borehole was open and dry upon completion of drilling.

Terraprobe

LOG OF BOREHOLE 3

PROJECT: Dixie Road Improvements **COORDINATES:** _____ **DATE:** October 09, 2008

LOCATION: Brampton, Ontario **EQUIPMENT:** Solid Stem Augers

CLIENT: AECOM **ELEVATION DATUM:** n/a **FILE:** 1-10-5140

SOIL PROFILE			SAMPLES			ELEVATION SCALE	PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT	ORGANIC VAPOUR	STANDPIPE INSTALLATION OR REMARKS
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		20 40 60 80 100; ○ UNCONFINED + FIELD VANE; ● POCKET PEN. × LAB VANE	w_P w w_L; WATER CONTENT (%) 10 20 30	(ppm)	
	Ground Surface									
0.0	155mm ASPHALT									
0.2	FILL - Gravel and Sand, trace to some silt, compact to very dense, brown, dry to damp		1	SS	84		GR.SA.SI&CL 49 .41 . 10	○		
			2	SS	24			○		
1.2	SILTY CLAY trace to some sand, trace gravel, occasional sand seams, very stiff, brown, damp (GLACIAL TILL)		3	SS	15			○		
1.8	End of Borehole									

NOTES:
Borehole was open and dry upon completion of drilling.

Terraprobe

LOG OF BOREHOLE 4

PROJECT: Dixie Road Improvements **COORDINATES:** _____ **DATE:** October 09, 2008

LOCATION: Brampton, Ontario **EQUIPMENT:** Pionjar

CLIENT: AECOM **ELEVATION DATUM:** n/a **FILE:** 1-10-5140

SOIL PROFILE			SAMPLES			ELEVATION SCALE	PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT	ORGANIC VAPOUR	STANDPIPE INSTALLATION OR REMARKS
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● POCKET PEN. × LAB VANE 20 40 60 80 100	w_P w w_L WATER CONTENT (%) 10 20 30	(ppm)	
0.0	Ground Surface									
	250mm TOPSOIL									
0.3	FILL - Silty Clay, trace sand, trace gravel, trace to some organics, brown, damp to moist		1	SS				○		
			2	SS			GR.SA.SI.CL 0 17 53 30	○		
1.2	SILTY CLAY sandy, trace gravel, brown, damp (GLACIAL TILL)		3	SS				○		
1.8	End of Borehole									

NOTES:
Borehole was open and dry upon completion of drilling.

Terraprobe

LOG OF BOREHOLE 5

PROJECT: Dixie Road Improvements **COORDINATES:** _____ **DATE:** October 09, 2008

LOCATION: Brampton, Ontario **EQUIPMENT:** Pionjar

CLIENT: AECOM **ELEVATION DATUM:** n/a **FILE:** 1-10-5140

SOIL PROFILE			SAMPLES			ELEVATION SCALE	PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED + FIELD VANE ● POCKET PEN. × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	ORGANIC VAPOUR (ppm)	STANDPIPE INSTALLATION OR REMARKS
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES					
Ground Surface										
0.0	180mm TOPSOIL									
0.2	FILL - Silty Clay, trace sand, trace gravel, brown, damp to moist		1	SS				○		
			2	SS				○		
			3	SS				○		
1.5	SILTY CLAY trace sand, trace gravel, brown / grey, damp to moist (GLACIAL TILL)							○		
1.8	End of Borehole									

NOTES:
Borehole was open and dry upon completion of drilling.

Terraprobe

LOG OF BOREHOLE 6

PROJECT: Dixie Road Improvements **COORDINATES:** _____ **DATE:** October 09, 2008

LOCATION: Brampton, Ontario **EQUIPMENT:** Pionjar

CLIENT: AECOM **ELEVATION DATUM:** n/a **FILE:** 1-10-5140

SOIL PROFILE			SAMPLES			ELEVATION SCALE	PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● POCKET PEN. × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L WATER CONTENT (%) 10 20 30	ORGANIC VAPOUR (ppm)	STANDPIPE INSTALLATION OR REMARKS
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES					
	Ground Surface									
0.0	200mm TOPSOIL									
0.2	FILL - Silty Clay, trace sand, trace gravel, trace organics, dark brown, damp		1	SS				○		
0.6	SILTY CLAY trace sand, trace gravel, brown, damp (GLACIAL TILL)		2	SS				○		
			3	SS				○		
1.8	End of Borehole									

NOTES:
Borehole was open and dry upon completion of drilling.

Terraprobe

LOG OF BOREHOLE 7

PROJECT: Dixie Road Improvements **COORDINATES:** _____ **DATE:** October 10, 2008

LOCATION: Brampton, Ontario **EQUIPMENT:** Bombardier/Solid Stem Augers

CLIENT: AECOM **ELEVATION DATUM:** n/a **FILE:** 1-10-5140

SOIL PROFILE			SAMPLES			ELEVATION SCALE	PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT	ORGANIC VAPOUR	STANDPIPE INSTALLATION OR REMARKS
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		20 40 60 80 100; ○ UNCONFINED + FIELD VANE; ● POCKET PEN. × LAB VANE	w_P w w_L; WATER CONTENT (%) 10 20 30	(ppm)	
	Ground Surface									
0.0	150mm ASPHALT									
0.2	445mm FILL - Gravel and Sand, trace silt, very dense, brown, dry		1	SS	64		GR.SA.SI&CL 48.46.6			
0.6	FILL - Silty Clay, trace sand, trace gravel, stiff, brown, damp		2	SS	12					
1.2	SILTY CLAY trace to some sand, trace gravel, hard, brown, damp (GLACIAL TILL)		3	SS	49					
1.8	End of Borehole									

NOTES:
Borehole was open and dry upon completion of drilling.

Terraprobe

LOG OF BOREHOLE 8

PROJECT: Dixie Road Improvements **COORDINATES:** _____ **DATE:** October 09, 2008

LOCATION: Brampton, Ontario **EQUIPMENT:** Pionjar

CLIENT: AECOM **ELEVATION DATUM:** n/a **FILE:** 1-10-5140

SOIL PROFILE			SAMPLES			ELEVATION SCALE	PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED + FIELD VANE ● POCKET PEN. × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	ORGANIC VAPOUR (ppm)	STANDPIPE INSTALLATION OR REMARKS
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES					
	Ground Surface									
0.0	200mm TOPSOIL									
0.2	FILL - Silty Clay, trace sand, trace gravel, brown, damp to moist		1	SS				○ at 20		
			2	SS				○ at 20		
			3	SS				○ at 30		
1.6	End of Borehole Sampler Refusal at 1.6m									

NOTES:
Borehole was open and dry upon completion of drilling.

Terraprobe

LOG OF BOREHOLE 9

PROJECT: Dixie Road Improvements **COORDINATES:** _____ **DATE:** October 09, 2008

LOCATION: Brampton, Ontario **EQUIPMENT:** Pionjar

CLIENT: AECOM **ELEVATION DATUM:** n/a **FILE:** 1-10-5140

SOIL PROFILE			SAMPLES			ELEVATION SCALE	PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● POCKET PEN., + FIELD VANE, × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%)	ORGANIC VAPOUR (ppm)	STANDPIPE INSTALLATION OR REMARKS
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		20 40 60 80 100	10 20 30		
	Ground Surface									
0.0	180mm TOPSOIL									
0.2	FILL - Silty Clay, trace to some sand, trace gravel, brown, dry to damp		1	SS				○		
			2	SS				○		
	---- topsoil stained / dark grey		3	SS				○		
1.8	End of Borehole									

NOTES:
Borehole was open and dry upon completion of drilling.

Terraprobe

LOG OF BOREHOLE 10

PROJECT: Dixie Road Improvements **COORDINATES:** _____ **DATE:** October 09, 2008

LOCATION: Brampton, Ontario **EQUIPMENT:** Pionjar

CLIENT: AECOM **ELEVATION DATUM:** n/a **FILE:** 1-10-5140

SOIL PROFILE			SAMPLES			ELEVATION SCALE	PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED ● POCKET PEN. + FIELD VANE × LAB VANE) 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) 10 20 30	ORGANIC VAPOUR (ppm)	STANDPIPE INSTALLATION OR REMARKS
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES					
0.0	Ground Surface 230mm TOPSOIL									
0.2	FILL - Silty Clay, trace sand, trace gravel, trace organics, occasional asphalt inclusions, brown, damp		1	SS				○		
			2	SS				○		
1.2	SILTY CLAY - Weathered, trace sand, trace gravel, brown, damp (GLACIAL TILL)		3	SS				○		
1.8	End of Borehole									

NOTES:
Borehole was open and dry upon completion of drilling.

Terraprobe

LOG OF BOREHOLE 11

PROJECT: Dixie Road Improvements **COORDINATES:** _____ **DATE:** October 10, 2008

LOCATION: Brampton, Ontario **EQUIPMENT:** Bombardier/Solid Stem Augers

CLIENT: AECOM **ELEVATION DATUM:** n/a **FILE:** 1-10-5140

SOIL PROFILE			SAMPLES			ELEVATION SCALE	PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT	ORGANIC VAPOUR	STANDPIPE INSTALLATION OR REMARKS
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		20 40 60 80 100; ○ UNCONFINED + FIELD VANE; ● POCKET PEN. × LAB VANE	w_P w w_L; WATER CONTENT (%) 10 20 30	(ppm)	
	Ground Surface									
0.0	145mm ASPHALT									
0.1	455mm FILL - Gravel and Sand, trace silt, dense, brown, dry		1	SS	44					
0.6	SILTY CLAY sandy, trace gravel, occasional sand seams, stiff to hard, brown, damp (GLACIAL TILL)		2	SS	12					
			3	SS	34					
1.8	End of Borehole									

NOTES:
Borehole was open and dry upon completion of drilling.

Terraprobe

LOG OF BOREHOLE 12

PROJECT: Dixie Road Improvements **COORDINATES:** _____ **DATE:** October 09, 2008

LOCATION: Brampton, Ontario **EQUIPMENT:** Pionjar

CLIENT: AECOM **ELEVATION DATUM:** n/a **FILE:** 1-10-5140

SOIL PROFILE			SAMPLES			ELEVATION SCALE	PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT	ORGANIC VAPOUR	STANDPIPE INSTALLATION OR REMARKS
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		20 40 60 80 100; ○ UNCONFINED + FIELD VANE; ● POCKET PEN. × LAB VANE	w_P w w_L; WATER CONTENT (%) 10 20 30	(ppm)	
	Ground Surface									
0.0	180mm TOPSOIL									
0.2	FILL - Silty Clay, trace sand, trace gravel, brown, damp to moist		1	SS						
			2	SS						
			3	SS						
1.8	End of Borehole									

NOTES:
Borehole was open and dry upon completion of drilling.

Terraprobe

LOG OF BOREHOLE 13

PROJECT: Dixie Road Improvements **COORDINATES:** _____ **DATE:** October 09, 2008

LOCATION: Brampton, Ontario **EQUIPMENT:** Pionjar

CLIENT: AECOM **ELEVATION DATUM:** n/a **FILE:** 1-10-5140

SOIL PROFILE			SAMPLES			ELEVATION SCALE	PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT	ORGANIC VAPOUR	STANDPIPE INSTALLATION OR REMARKS
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		20 40 60 80 100; ○ UNCONFINED + FIELD VANE; ● POCKET PEN. × LAB VANE; 20 40 60 80 100	w_P w w_L; WATER CONTENT (%) 10 20 30	(ppm)	
	Ground Surface									
0.0	130mm TOPSOIL									
0.1	FILL - Silty Clay, trace to some sand, trace gravel, brown, damp to moist		1	SS				○		
			2	SS				○		
			3	SS				○		
1.8	End of Borehole									

NOTES:
Borehole was open and dry upon completion of drilling.

Terraprobe

LOG OF BOREHOLE 14

PROJECT: Dixie Road Improvements **COORDINATES:** **DATE:** October 10, 2008

LOCATION: Brampton, Ontario **EQUIPMENT:** Pionjar

CLIENT: AECOM **ELEVATION DATUM:** n/a **FILE:** 1-10-5140

SOIL PROFILE			SAMPLES			ELEVATION SCALE	PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT	ORGANIC VAPOUR	STANDPIPE INSTALLATION OR REMARKS
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● POCKET PEN. × LAB VANE 20 40 60 80 100	w_P w w_L WATER CONTENT (%) 10 20 30	(ppm)	
	Ground Surface									
0.0	180mm TOPSOIL									
0.2	FILL - Silty Clay, trace sand, trace gravel, brown, damp		1	SS				○		
0.6	FILL - Sand and Silt, trace sand, trace to some gravel, brown, damp to moist		2	SS			GR.SA.SI.CL 19.38.36.7	○		
1.2	End of Borehole * Borehole terminated at 1.2m due to obstruction									

NOTES:
Borehole was open and dry upon completion of drilling.

Terraprobe

LOG OF BOREHOLE 15

PROJECT: Dixie Road Improvements **COORDINATES:** _____ **DATE:** October 10, 2008

LOCATION: Brampton, Ontario **EQUIPMENT:** Bombardier/Solid Stem Augers

CLIENT: AECOM **ELEVATION DATUM:** n/a **FILE:** 1-10-5140

SOIL PROFILE			SAMPLES			ELEVATION SCALE	PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT	ORGANIC VAPOUR	STANDPIPE INSTALLATION OR REMARKS
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		20 40 60 80 100; ○ UNCONFINED + FIELD VANE; ● POCKET PEN. × LAB VANE; 20 40 60 80 100	w_P w w_L; WATER CONTENT (%) 10 20 30	(ppm)	
Ground Surface										
0.0	165mm ASPHALT									
0.2	445mm FILL - Sandy Gravel, trace silt, very dense, brown, dry		1	SS	83		GR.SA.SI&CL 63 .32 . 5	○		
0.6	FILL - Silty Clay, and sand, trace gravel, stiff, brown, damp		2	SS	17		GR.SA.SI.CL 5 .36 .40.19	○		
1.2	SILTY CLAY trace sand, trace gravel, very stiff, brown, damp (GLACIAL TILL)		3	SS	25			○		
1.8	End of Borehole									

NOTES:
Borehole was open and dry upon completion of drilling.

Terraprobe

LOG OF BOREHOLE 16

PROJECT: Dixie Road Improvements **COORDINATES:** **DATE:** October 09, 2008

LOCATION: Brampton, Ontario **EQUIPMENT:** Pionjar

CLIENT: AECOM **ELEVATION DATUM:** n/a **FILE:** 1-10-5140

SOIL PROFILE			SAMPLES			ELEVATION SCALE	PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● POCKET PEN., + FIELD VANE, × LAB VANE)	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT (w_P, w, w_L) WATER CONTENT (%)	ORGANIC VAPOUR (ppm)	STANDPIPE INSTALLATION OR REMARKS
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		20 40 60 80 100	10 20 30		
	Ground Surface									
0.0	150mm TOPSOIL									
0.2	FILL - Silty Clay, trace sand to sandy, trace gravel, occasional asphalt inclusions, brown, dry to damp		1	SS				○		
			2	SS				○		
			3	SS				○		
1.5	End of Borehole									

NOTES:
Borehole was open and dry upon completion of drilling.

Terraprobe

LOG OF BOREHOLE 17

PROJECT: Dixie Road Improvements **COORDINATES:** _____ **DATE:** October 09, 2008

LOCATION: Brampton, Ontario **EQUIPMENT:** Pionjar

CLIENT: AECOM **ELEVATION DATUM:** n/a **FILE:** 1-10-5140

SOIL PROFILE			SAMPLES			ELEVATION SCALE	PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa 20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● POCKET PEN. × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L WATER CONTENT (%) 10 20 30	ORGANIC VAPOUR (ppm)	STANDPIPE INSTALLATION OR REMARKS
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES					
Ground Surface										
0.0	230mm TOPSOIL									
0.2	FILL - Silty Clay, trace sand, trace gravel, trace rootlets, brown, damp		1	SS				○		
			2	SS				○		
1.2	SILTY CLAY trace sand to sandy, trace gravel, brown, damp (GLACIAL TILL)		3	SS				○		
1.8	End of Borehole									

NOTES:
Borehole was open and dry upon completion of drilling.

Terraprobe

LOG OF BOREHOLE 18

PROJECT: Dixie Road Improvements **COORDINATES:** _____ **DATE:** October 09, 2008

LOCATION: Brampton, Ontario **EQUIPMENT:** Pionjar

CLIENT: AECOM **ELEVATION DATUM:** n/a **FILE:** 1-10-5140

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	ELEVATION SCALE	PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● POCKET PEN., + FIELD VANE, × LAB VANE) 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) 10 20 30	ORGANIC VAPOUR (ppm)	STANDPIPE INSTALLATION OR REMARKS
	Ground Surface									
0.0	250mm TOPSOIL									
0.3	FILL - Silty Clay, trace sand, trace gravel, trace organics, brown, damp to moist		1	SS				○		
			2	SS				○		
			3	SS				○		
			4	SS				○		
2.4	FILL - Sand and Gravel, trace clay, trace silt, brown, dry to damp		5	SS				○		
3.0	End of Borehole									

NOTES:
Borehole was open and dry upon completion of drilling.

Terraprobe

LOG OF BOREHOLE 19

PROJECT: Dixie Road Improvements **COORDINATES:** _____ **DATE:** October 10, 2008

LOCATION: Brampton, Ontario **EQUIPMENT:** Bombardier/Solid Stem Augers

CLIENT: AECOM **ELEVATION DATUM:** n/a **FILE:** 1-10-5140

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	ORGANIC VAPOUR (ppm)	STANDPIPE INSTALLATION OR REMARKS
	Ground Surface						20 40 60 80 100	10 20 30		
0.0	150mm ASPHALT									
0.2	450mm FILL - Gravel and Sand, trace silt, very dense, brown, dry		1	SS	55					
0.6	SILTY CLAY some sand to sandy, trace gravel, stiff, brown, damp to moist		2	SS	11					
1.2	SILT AND SAND trace clay, trace gravel, occasional cobbles, dense, brown, moist to wet		3	SS	47		GR.SA.SI.CL 5 .42 .45. 8			
1.8	End of Borehole									

NOTES:
Borehole was open and dry upon completion of drilling.

Terraprobe

LOG OF BOREHOLE 20

PROJECT: Dixie Road Improvements **COORDINATES:** _____ **DATE:** October 09, 2008

LOCATION: Brampton, Ontario **EQUIPMENT:** Pionjar

CLIENT: AECOM **ELEVATION DATUM:** n/a **FILE:** 1-10-5140

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● POCKET PEN., + FIELD VANE, × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	ORGANIC VAPOUR (ppm)	STANDPIPE INSTALLATION OR REMARKS
	Ground Surface						20 40 60 80 100	10 20 30		
0.0	250mm TOPSOIL									
0.3	FILL - Sand, trace to some gravel, occasional silty clay inclusions, brown, damp		1	SS				○		
0.6	FILL - Silty Clay, trace sand, trace gravel, brown, damp		2	SS				○		
1.2	SILTY CLAY trace to some sand, trace gravel, grey, damp (GLACIAL TILL)		3	SS				○		
1.8	End of Borehole									

NOTES:
Borehole was open and dry upon completion of drilling.

Terraprobe

LOG OF BOREHOLE 22

PROJECT: Dixie Road Improvements **COORDINATES:** **DATE:** October 10, 2008

LOCATION: Brampton, Ontario **EQUIPMENT:** Pionjar

CLIENT: AECOM **ELEVATION DATUM:** n/a **FILE:** 1-10-5140

SOIL PROFILE			SAMPLES			ELEVATION SCALE	PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT	ORGANIC VAPOUR	STANDPIPE INSTALLATION OR REMARKS
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		20 40 60 80 100; ○ UNCONFINED + FIELD VANE; ● POCKET PEN. × LAB VANE; 20 40 60 80 100	w_P w w_L; WATER CONTENT (%) 10 20 30	(ppm)	
	Ground Surface									
0.0	150mm TOPSOIL									
0.2	FILL - Silty Clay, trace sand, trace gravel, trace organics, brown / dark brown, damp		1	SS				○		
			2	SS				○		
1.2	SILTY CLAY trace sand, trace gravel, brown, damp (GLACIAL TILL)		3	SS				○		
1.8	End of Borehole									

NOTES:
Borehole was open and dry upon completion of drilling.

Terraprobe

LOG OF BOREHOLE 23

PROJECT: Dixie Road Improvements **COORDINATES:** _____ **DATE:** October 10, 2008

LOCATION: Brampton, Ontario **EQUIPMENT:** Solid Stem Augers

CLIENT: AECOM **ELEVATION DATUM:** n/a **FILE:** 1-10-5140

SOIL PROFILE			SAMPLES			ELEVATION SCALE	PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT	ORGANIC VAPOUR	STANDPIPE INSTALLATION OR REMARKS
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		20 40 60 80 100; ○ UNCONFINED + FIELD VANE; ● POCKET PEN. × LAB VANE; 20 40 60 80 100	w_P w w_L; WATER CONTENT (%) 10 20 30	(ppm)	
0.0	Ground Surface 150mm ASPHALT									
0.2	450mm FILL - Sandy Gravel, trace silt, very dense, brown, dry		1	SS	54		GR.SA.SI&CL 66 28 . 6	○		
0.6	SILTY CLAY trace sand, trace gravel, very stiff to hard, brown, damp (GLACIAL TILL)		2	SS	17			○		
			3	SS	70			○		
1.8	End of Borehole									

NOTES:
Borehole was open and dry upon completion of drilling.

Terraprobe

LOG OF BOREHOLE 24

PROJECT: Dixie Road Improvements **COORDINATES:** _____ **DATE:** October 10, 2008

LOCATION: Brampton, Ontario **EQUIPMENT:** Pionjar

CLIENT: AECOM **ELEVATION DATUM:** n/a **FILE:** 1-10-5140

SOIL PROFILE			SAMPLES			ELEVATION SCALE	PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● POCKET PEN., + FIELD VANE, × LAB VANE) 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) 10 20 30	ORGANIC VAPOUR (ppm)	STANDPIPE INSTALLATION OR REMARKS
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES					
	Ground Surface									
0.0	180mm TOPSOIL									
0.2	FILL - Silty Clay, trace sand, trace gravel, brown, damp		1	SS				○		
0.6	SILTY CLAY trace sand, trace gravel, brown, damp (GLACIAL TILL)		2	SS				○		
			3	SS				○		
1.8	End of Borehole									

NOTES:
Borehole was open and dry upon completion of drilling.

Terraprobe

LOG OF BOREHOLE 25

PROJECT: Dixie Road Improvements **COORDINATES:** _____ **DATE:** October 10, 2008

LOCATION: Brampton, Ontario **EQUIPMENT:** Pionjar

CLIENT: AECOM **ELEVATION DATUM:** n/a **FILE:** 1-10-5140

SOIL PROFILE			SAMPLES			ELEVATION SCALE	PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (20 40 60 80 100) ○ UNCONFINED ● POCKET PEN. + FIELD VANE × LAB VANE	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	ORGANIC VAPOUR (ppm)	STANDPIPE INSTALLATION OR REMARKS
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES					
0.0	Ground Surface 200mm TOPSOIL									
0.2	FILL - Silty Clay, trace sand, trace gravel, trace organics, brown / dark brown, damp to moist		1	SS				○		
			2	SS				○		
1.2	SILTY CLAY - Weathered, trace sand, trace gravel, brown, damp (GLACIAL TILL)		3	SS				○		
1.8	End of Borehole									

NOTES:
Borehole was open and dry upon completion of drilling.

Terraprobe

LOG OF BOREHOLE 26

PROJECT: Dixie Road Improvements **COORDINATES:** **DATE:** October 10, 2008

LOCATION: Brampton, Ontario **EQUIPMENT:** Pionjar

CLIENT: AECOM **ELEVATION DATUM:** n/a **FILE:** 1-10-5140

SOIL PROFILE			SAMPLES			ELEVATION SCALE	PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● POCKET PEN., + FIELD VANE, × LAB VANE)	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT (w_P, w, w_L) WATER CONTENT (%)	ORGANIC VAPOUR (ppm)	STANDPIPE INSTALLATION OR REMARKS
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		20 40 60 80 100	10 20 30		
	Ground Surface									
0.0	150mm TOPSOIL									
0.2	FILL - Silty Clay, trace sand, trace gravel, brown, damp		1	SS				○		
0.6	End of Borehole * Borehole terminated at 0.6m due to obstruction									

NOTES:
Borehole was open and dry upon completion of drilling.

Terraprobe

LOG OF BOREHOLE 27

PROJECT: Dixie Road Improvements **COORDINATES:** _____ **DATE:** October 10, 2008

LOCATION: Brampton, Ontario **EQUIPMENT:** Bombardier/Solid Stem Augers

CLIENT: AECOM **ELEVATION DATUM:** n/a **FILE:** 1-10-5140

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	ELEVATION SCALE	PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● POCKET PEN., + FIELD VANE, × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	ORGANIC VAPOUR (ppm)	STANDPIPE INSTALLATION OR REMARKS
	Ground Surface						20 40 60 80 100	10 20 30		
0.0	145mm ASPHALT									
0.1	560mm FILL - Sand and Gravel, trace silt, dense, brown, damp to moist ---- frequent crushed limestone inclusions		1	SS	36		GR.SA.SI&CL 42 49 . 9	○		
0.7	SILTY CLAY trace to some sand, trace gravel, very stiff to hard, brown, damp (GLACIAL TILL)		2	SS	21			○		
			3	SS	46			○		
1.8	End of Borehole									

NOTES:
Borehole was open and dry upon completion of drilling.

Terraprobe

LOG OF BOREHOLE 28

PROJECT: Dixie Road Improvements **COORDINATES:** **DATE:** October 10, 2008

LOCATION: Brampton, Ontario **EQUIPMENT:** Pionjar

CLIENT: AECOM **ELEVATION DATUM:** n/a **FILE:** 1-10-5140

SOIL PROFILE			SAMPLES			ELEVATION SCALE	PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT	ORGANIC VAPOUR	STANDPIPE INSTALLATION OR REMARKS
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		20 40 60 80 100; ○ UNCONFINED + FIELD VANE; ● POCKET PEN. × LAB VANE; 20 40 60 80 100	w_P w w_L; WATER CONTENT (%) 10 20 30	(ppm)	
	Ground Surface									
0.0	200mm TOPSOIL									
0.2	FILL - Silty Clay, trace sand, trace gravel, brown / dark brown, damp to moist --- trace organics, topsoil stained below 0.6m		1	SS				○		
			2	SS				○		
			3	SS				○		
1.8	End of Borehole									

NOTES:
Borehole was open and dry upon completion of drilling.

Terraprobe

LOG OF BOREHOLE 29

PROJECT: Dixie Road Improvements **COORDINATES:** _____ **DATE:** October 10, 2008

LOCATION: Brampton, Ontario **EQUIPMENT:** Pionjar

CLIENT: AECOM **ELEVATION DATUM:** n/a **FILE:** 1-10-5140

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	ORGANIC VAPOUR (ppm)	STANDPIPE INSTALLATION OR REMARKS
	Ground Surface						○ UNCONFINED + FIELD VANE ● POCKET PEN. × LAB VANE			
0.0	180mm TOPSOIL									
0.2	FILL - Sand and Gravel, trace clay, trace silt, brown, moist		1	SS				○		
0.6	SANDY SILT trace clay, brown, wet		2	SS				○		
			3	SS			GR.SA.SI.CL 0 .25 .65 .10	○		
1.8	End of Borehole									

NOTES:
Borehole was open and dry upon completion of drilling.

Terraprobe

LOG OF BOREHOLE 30

PROJECT: Dixie Road Improvements **COORDINATES:** **DATE:** October 10, 2008

LOCATION: Brampton, Ontario **EQUIPMENT:** Pionjar

CLIENT: AECOM **ELEVATION DATUM:** n/a **FILE:** 1-10-5140

SOIL PROFILE			SAMPLES			ELEVATION SCALE	PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT	ORGANIC VAPOUR	STANDPIPE INSTALLATION OR REMARKS
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● POCKET PEN. × LAB VANE 20 40 60 80 100	w_P w w_L WATER CONTENT (%) 10 20 30	(ppm)	
0.0	Ground Surface 150mm TOPSOIL									
0.2	SILTY CLAY sandy, trace gravel, brown, damp (GLACIAL TILL)		1	SS				○		
			2	SS			GR.SA.SI.CL 6 .23 .46.25	○		
			3	SS				○		
1.8	End of Borehole									

NOTES:
Borehole was open and dry upon completion of drilling.

Terraprobe

LOG OF BOREHOLE 32

PROJECT: Dixie Road Improvements **COORDINATES:** **DATE:** October 10, 2008

LOCATION: Brampton, Ontario **EQUIPMENT:** Pionjar

CLIENT: AECOM **ELEVATION DATUM:** n/a **FILE:** 1-10-5140

SOIL PROFILE			SAMPLES			ELEVATION SCALE	PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● POCKET PEN., + FIELD VANE, × LAB VANE)	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT (w_P, w, w_L) WATER CONTENT (%)	ORGANIC VAPOUR (ppm)	STANDPIPE INSTALLATION OR REMARKS
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		20 40 60 80 100	10 20 30		
	Ground Surface									
0.0	200mm TOPSOIL									
0.2	FILL - Silty Clay, trace sand, trace gravel, trace organics, brown, damp		1	SS						
0.6	SILTY CLAY sandy, trace gravel, brown, damp (GLACIAL TILL)		2	SS						
			3	SS						
1.8	End of Borehole									

NOTES:
Borehole was open and dry upon completion of drilling.

Terraprobe

LOG OF BOREHOLE 33

PROJECT: Dixie Road Improvements **COORDINATES:** **DATE:** October 10, 2008

LOCATION: Brampton, Ontario **EQUIPMENT:** Pionjar

CLIENT: AECOM **ELEVATION DATUM:** n/a **FILE:** 1-10-5140

SOIL PROFILE			SAMPLES			ELEVATION SCALE	PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● POCKET PEN., + FIELD VANE, × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	ORGANIC VAPOUR (ppm)	STANDPIPE INSTALLATION OR REMARKS
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		20 40 60 80 100	10 20 30		
	Ground Surface									
0.0	230mm TOPSOIL									
0.2	FILL - Sand and Gravel, trace silt, brown, dry		1	SS				○		
0.6	FILL - Silty Clay, trace sand, trace gravel, trace to some organics, brown / dark brown, damp to moist		2	SS						
	---- dark brown / grey									
1.5	SILTY CLAY - trace sand, brown, damp (GLACIAL TILL)		3	SS				○		
1.8	End of Borehole									

NOTES:
Borehole was open and dry upon completion of drilling.

Terraprobe

LOG OF BOREHOLE 34

PROJECT: Dixie Road Improvements
LOCATION: Brampton, Ontario
CLIENT: AECOM
COORDINATES:
EQUIPMENT: Bombardier/Solid Stem Augers
ELEVATION DATUM: n/a
DATE: October 15, 2008
FILE: 1-10-5140

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES
217.7	Ground Surface				
0.0 / 217.5	200mm TOPSOIL				
0.2	FILL - Silty Clay, trace sand, trace gravel, stiff to very stiff, brown, damp to moist		1	SS	15
			2	SS	8
			3	SS	10
214.8			4	SS	19
2.9	SAND AND SILT trace clay, trace to some gravel, occasional cobbles, very dense, brown, damp to moist (GLACIAL TILL)		5	SS	58
	grey		6	SS	50/13cm
			7	SS	50/3cm
210.8			8	SS	50/5cm
6.9	SAND AND GRAVEL trace silt, very dense, grey, moist				
210.0			9	SS	50/5cm
7.7	End of Borehole				

Piezometer Installation consists of 19mm diameter, schedule 140 POC pipe enclosed in filler sand.

Water Level Readings:

Date	Depth(m)	Elevation(m)
Nov.19.08	2.7	215.0
Dec.01.08	2.6	215.1

ELEVATION SCALE: 217, 216, 215, 214, 213, 212, 211, 210

PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH kPa: ○ UNCONFINED ● POCKET PEN. + FIELD VANE × LAB VANE; 20 40 60 80 100

* Sampler wet
GR.SA.SI.CL
11.43.42.4

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L

WATER CONTENT (%): 10 20 30

ORGANIC VAPOUR (ppm)

STANDPIPE INSTALLATION OR REMARKS

NOTES:
Wet cave at 3.4m (Elev. 214.3m) upon completion of drilling.

Terraprobe

LOG OF BOREHOLE 10-1

PROJECT: Dixie Road Improvements **COORDINATES:** **DATE:** July 26, 2010

LOCATION: Brampton, Ontario **EQUIPMENT:** Solid Stem Augers

CLIENT: AECOM **ELEVATION DATUM:** n/a **FILE:** 1-10-5140

SOIL PROFILE			SAMPLES			ELEVATION SCALE	PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT / WATER CONTENT (%)	ORGANIC VAPOUR (ppm)	STANDPIPE INSTALLATION OR REMARKS
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		20 40 60 80 100	10 20 30		
	Ground Surface						○ UNCONFINED + FIELD VANE ● POCKET PEN. × LAB VANE	w_P w w_L		
0.0	930mm FILL - Gravelly Sand, trace silt, very dense, brown, damp		1	SS	50/13cm					
			2	SS	57					
0.9	FILL - Silty Clay, some sand, trace gravel, trace organics, stiff to hard, brown, damp to moist		3	SS	10		GR.SA.SI.CL 2 .19 .48.31			
1.8	End of Borehole									

NOTES:
Borehole was dry (not stabilized) and hole open to full depth on completion.

Terraprobe

LOG OF BOREHOLE 10-2

PROJECT: Dixie Road Improvements **COORDINATES:** **DATE:** July 26, 2010

LOCATION: Brampton, Ontario **EQUIPMENT:** Solid Stem Augers

CLIENT: AECOM **ELEVATION DATUM:** n/a **FILE:** 1-10-5140

SOIL PROFILE			SAMPLES			ELEVATION SCALE	PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT / WATER CONTENT (%)	ORGANIC VAPOUR (ppm)	STANDPIPE INSTALLATION OR REMARKS
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		20 40 60 80 100	10 20 30		
0.0	Ground Surface 710mm FILL - Sand and Gravel, trace silt, dense, brown, damp		1	SS	41		GR.SA.SI & CL 40.51.9			
0.7	FILL - Silty Clay, trace to some sand, trace gravel, stiff, brown, damp to moist		2	SS	13					
			3	SS	11					
1.8	End of Borehole									

PENETRATION RESISTANCE PLOT
SHEAR STRENGTH kPa
○ UNCONFINED + FIELD VANE
● POCKET PEN. × LAB VANE

PLASTIC LIMIT w_P NATURAL MOISTURE CONTENT w LIQUID LIMIT w_L
WATER CONTENT (%)

NOTES:
Borehole was dry (not stabilized) and hole open to full depth on completion.

Terraprobe

LOG OF BOREHOLE 10-3

PROJECT: Dixie Road Improvements **COORDINATES:** _____ **DATE:** July 26, 2010

LOCATION: Brampton, Ontario **EQUIPMENT:** Solid Stem Augers

CLIENT: AECOM **ELEVATION DATUM:** n/a **FILE:** 1-10-5140

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● POCKET PEN., + FIELD VANE, × LAB VANE) 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) 10 20 30	ORGANIC VAPOUR (ppm)	STANDPIPE INSTALLATION OR REMARKS
	Ground Surface						20 40 60 80 100			
0.0	155mm ASPHALT									
0.2	735mm FILL - Sand and Gravel, trace silt, dense to very dense, brown, damp		1	SS	50/10cm					
0.9	SILTY CLAY trace to some sand, trace gravel, very stiff to hard, brown, damp to moist (GLACIAL TILL)		2	SS	32					
			3	SS	27					
1.8	End of Borehole									

NOTES:
Borehole was dry (not stabilized) and hole open to full depth on completion.

Terraprobe

LOG OF BOREHOLE 10-4

PROJECT: Dixie Road Improvements **COORDINATES:** _____ **DATE:** July 26, 2010

LOCATION: Brampton, Ontario **EQUIPMENT:** Solid Stem Augers

CLIENT: AECOM **ELEVATION DATUM:** n/a **FILE:** 1-10-5140

SOIL PROFILE			SAMPLES			ELEVATION SCALE	PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT	ORGANIC VAPOUR	STANDPIPE INSTALLATION OR REMARKS
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		20 40 60 80 100; ○ UNCONFINED + FIELD VANE; ● POCKET PEN. × LAB VANE; 20 40 60 80 100	w_P w w_L; WATER CONTENT (%); 10 20 30	(ppm)	
	Ground Surface									
0.0	135mm ASPHALT									
0.1	925mm FILL - Sand and Gravel, trace silt, very dense, brown, damp		1	SS	50/13cm			○		
			2	SS	100/28cm			○		
1.1	SILTY CLAY trace to some sand, trace gravel, very stiff, brown, damp to moist (GLACIAL TILL)		3	SS	29			○		
1.8	End of Borehole									

NOTES:
Borehole was dry (not stabilized) and hole open to full depth on completion.

Terraprobe

LOG OF BOREHOLE 10-5

PROJECT: Dixie Road Improvements
LOCATION: Brampton, Ontario
CLIENT: AECOM
COORDINATES:
EQUIPMENT: Solid Stem Augers
ELEVATION DATUM: n/a
DATE: July 26, 2010
FILE: 1-10-5140

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	ELEVATION SCALE
101.1	Ground Surface					
100.0 / 0.1	125mm ASPHALT					101
	FILL - Sand and Gravel, trace silt, compact to very dense, brown, damp to moist		1	SS	57	
			2	SS	50/13cm	100
			3	SS	50/10cm	
			4	SS	50/10cm	99
			5	SS	17	98
97.4 / 3.7	firm		6	SS	6	97
			7	SS	33	
	SILTY CLAY to CLAYEY SILT sandy, gravelly, hard, brown/grey, damp to moist (GLACIAL TILL)		8	SS	31	96
			9	SS	68	95
						94
						93
91.5			10	SS	31	92
9.6	End of Borehole					

GR.SA.SI.CL
24.27.37.12

PENETRATION RESISTANCE PLOT: 20 40 60 80 100
SHEAR STRENGTH kPa: ○ UNCONFINED ● POCKET PEN. + FIELD VANE × LAB VANE (20 40 60 80 100)
PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%): 10 20 30
ORGANIC VAPOUR (ppm)
STANDPIPE INSTALLATION OR REMARKS

NOTES:
Wet cave at 3.7m upon completion of drilling.
No sample recovery in SS8. Disturbed sample collected.

Terraprobe

LOG OF BOREHOLE 10-6

PROJECT: Dixie Road Improvements **COORDINATES:** _____ **DATE:** July 26, 2010

LOCATION: Brampton, Ontario **EQUIPMENT:** Solid Stem Augers

CLIENT: AECOM **ELEVATION DATUM:** n/a **FILE:** 1-10-5140

SOIL PROFILE			SAMPLES			ELEVATION SCALE	PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT	ORGANIC VAPOUR	STANDPIPE INSTALLATION OR REMARKS
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		20 40 60 80 100 ○ UNCONFINED ● POCKET PEN. + FIELD VANE × LAB VANE	w_P w w_L WATER CONTENT (%) 10 20 30	(ppm)	
	Ground Surface									
0.0	20mm TOPSOIL									
0.2	620mm FILL - Sand and Gravel, trace silt, compact, brown, moist		1	SS	12			○		
0.8	FILL - Silty Clay, some sand to sandy, trace gravel, stiff to very stiff, brown/grey, damp to moist		2	SS	10			○		
			3	SS	28			○		
1.8	End of Borehole									

NOTES:

Borehole was dry (not stabilized) and hole open to full depth on completion.
No sample recovery in SS2 and SS 3. Disturbed sample collected from augers.

Terraprobe

LOG OF BOREHOLE 10-7

PROJECT: Dixie Road Improvements **COORDINATES:** _____ **DATE:** July 26, 2010

LOCATION: Brampton, Ontario **EQUIPMENT:** Solid Stem Augers

CLIENT: AECOM **ELEVATION DATUM:** n/a **FILE:** 1-10-5140

SOIL PROFILE			SAMPLES			ELEVATION SCALE	PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT	ORGANIC VAPOUR	STANDPIPE INSTALLATION OR REMARKS
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		20 40 60 80 100; ○ UNCONFINED + FIELD VANE; ● POCKET PEN. × LAB VANE; 20 40 60 80 100	w_P w w_L; WATER CONTENT (%) 10 20 30	(ppm)	
	Ground Surface									
0.0	150mm ASPHALT									
0.2	440mm FILL -Sand and Gravel, some silt, very dense, brown, damp		1	SS	75		GR.SA.SI & CL 43.46 .11	○		
0.6	FILL - Silty Clay, trace to some sand, trace gravel, trace organics, very stiff, dark brown/black, damp to moist		2	SS	19			○		
0.9	SILTY CLAY, trace to some sand, trace gravel, very stiff to hard, brown, damp to moist (GLACIAL TILL)		3	SS	30			○		
1.8	End of Borehole									

NOTES:
Borehole was dry (not stabilized) and hole open to full depth on completion.

Terraprobe

LOG OF BOREHOLE BD1

PROJECT: Dixie Road Improvements **COORDINATES:** _____ **DATE:** October 10, 2008

LOCATION: Brampton, Ontario **EQUIPMENT:** Solid Stem Augers

CLIENT: AECOM **ELEVATION DATUM:** n/a **FILE:** 1-10-5140

SOIL PROFILE			SAMPLES			ELEVATION SCALE	PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT	ORGANIC VAPOUR	STANDPIPE INSTALLATION OR REMARKS
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		20 40 60 80 100	w_P w w_L	(ppm)	
	Ground Surface						○ UNCONFINED + FIELD VANE ● POCKET PEN. × LAB VANE	WATER CONTENT (%) 10 20 30		
0.0	140mm ASPHALT									
0.1	620mm FILL - Sand and Gravel, trace silt, dense, brown, dry		1	SS	48					
			2	SS	50/15cm					
0.8	SILTY CLAY trace sand, trace gravel, occasional cobbles, hard, brown, damp (GLACIAL TILL)		3	SS	50/10cm					
1.3	End of Borehole									

NOTES:
Borehole was open and dry upon completion of drilling.

Terraprobe

LOG OF BOREHOLE CD1

PROJECT: Dixie Road Improvements **COORDINATES:** _____ **DATE:** October 09, 2008

LOCATION: Brampton, Ontario **EQUIPMENT:** Solid Stem Augers

CLIENT: AECOM **ELEVATION DATUM:** n/a **FILE:** 1-10-5140

SOIL PROFILE			SAMPLES			ELEVATION SCALE	PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● POCKET PEN., + FIELD VANE, × LAB VANE) 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) 10 20 30	ORGANIC VAPOUR (ppm)	STANDPIPE INSTALLATION OR REMARKS
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES					
0.0	Ground Surface 165mm ASPHALT									
0.2	470mm FILL - Sand and Gravel, trace silt, compact, brown, damp		1	SS	22			○		
0.6	SILTY CLAY trace to some sand, trace gravel, stiff to very stiff, brown, damp to moist (GLACIAL TILL)		2	SS	14			○		
			3	SS	21			○		
1.8	End of Borehole									

NOTES:
Borehole was open and dry upon completion of drilling.

Terraprobe

LOG OF BOREHOLE HB1

PROJECT: Dixie Road Improvements **COORDINATES:** _____ **DATE:** October 14, 2008

LOCATION: Brampton, Ontario **EQUIPMENT:** Solid Stem Augers

CLIENT: AECOM **ELEVATION DATUM:** n/a **FILE:** 1-10-5140

SOIL PROFILE			SAMPLES			ELEVATION SCALE	PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● POCKET PEN., + FIELD VANE, × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	ORGANIC VAPOUR (ppm)	STANDPIPE INSTALLATION OR REMARKS
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		20 40 60 80 100	10 20 30		
	Ground Surface									
0.0	140mm ASPHALT									
0.1	660mm FILL - Sand, trace to some gravel, trace silt, brown, dry		1	AS				○		
0.8	SAND AND SILT trace to some clay, brown, damp		2	AS				○		
1.5	End of Borehole * SPT testing equipment broken. Auger samples collected.									

NOTES:
Borehole was open and dry upon completion of drilling.

Terraprobe

LOG OF BOREHOLE MR1

PROJECT: Dixie Road Improvements **COORDINATES:** **DATE:** October 09, 2008

LOCATION: Brampton, Ontario **EQUIPMENT:** Solid Stem Augers

CLIENT: AECOM **ELEVATION DATUM:** n/a **FILE:** 1-10-5140

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES
	Ground Surface				
0.0	260mm ASPHALT				
0.3	550mm FILL - Gravel and Sand, trace silt, dense, brown, dry		1	SS	38
			2	SS	8
0.8	FILL - Silty Clay, trace sand, trace gravel, trace organics, stiff to very stiff, grey, damp to moist		3	SS	16
			4	SS	14
2.3	SILTY CLAY - trace sand, trace gravel, inferred very stiff, grey, damp				
2.4	End of Borehole				

ELEVATION SCALE

PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH kPa
○ UNCONFINED + FIELD VANE
● POCKET PEN. × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L

WATER CONTENT (%)
10 20 30

ORGANIC VAPOUR (ppm)

STANDPIPE INSTALLATION OR REMARKS

NOTES:
Borehole was open and dry upon completion of drilling.

Terraprobe

LOG OF BOREHOLE NP1

PROJECT: Dixie Road Improvements **COORDINATES:** _____ **DATE:** October 14, 2008

LOCATION: Brampton, Ontario **EQUIPMENT:** Manual SPT

CLIENT: AECOM **ELEVATION DATUM:** n/a **FILE:** 1-10-5140

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	ELEVATION SCALE	PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● POCKET PEN., + FIELD VANE, × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	ORGANIC VAPOUR (ppm)	STANDPIPE INSTALLATION OR REMARKS
	Ground Surface						20 40 60 80 100	10 20 30		
0.0	140mm ASPHALT				**					
0.1	320mm FILL - Sand and Gravel, trace silt, compact, brown, damp		1	SS	12			○		
0.5	SILTY CLAY trace sand, trace gravel, stiff to hard, brown, damp (GLACIAL TILL)		2	SS	13			○		
			3	SS	50/25cm			○		
1.6	End of Borehole									

* Mechanical SPT equipment broken. SPT testing undertaken manually.

** Corrected "N" value based on a 31.75Kg hammer dropping 760mm approximately.

NOTES:
Borehole was open and dry upon completion of drilling.

Terraprobe

LOG OF BOREHOLE PR1

PROJECT: Dixie Road Improvements **COORDINATES:** **DATE:** October 14, 2008

LOCATION: Brampton, Ontario **EQUIPMENT:** Solid Stem Augers

CLIENT: AECOM **ELEVATION DATUM:** n/a **FILE:** 1-10-5140

SOIL PROFILE			SAMPLES			ELEVATION SCALE	PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT / WATER CONTENT (%)	ORGANIC VAPOUR (ppm)	STANDPIPE INSTALLATION OR REMARKS
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		20 40 60 80 100	10 20 30		
0.0	Ground Surface 115mm ASPHALT									
0.1	365mm FILL - Sand and Gravel, trace silt, dense, brown, damp		1	SS	39					
0.5	SILTY CLAY trace to some sand, trace gravel, very stiff, brown, damp (GLACIAL TILL)		2	SS	21					
			3	SS	26					
1.8	End of Borehole									

PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● POCKET PEN. × LAB VANE (20 40 60 80 100)

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L

WATER CONTENT (%): 10 20 30

NOTES:
Borehole was open and dry upon completion of drilling.

Terraprobe

LOG OF BOREHOLE SP1

PROJECT: Dixie Road Improvements **COORDINATES:** _____ **DATE:** October 10, 2008

LOCATION: Brampton, Ontario **EQUIPMENT:** Solid Stem Augers

CLIENT: AECOM **ELEVATION DATUM:** n/a **FILE:** 1-10-5140

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	ORGANIC VAPOUR (ppm)	STANDPIPE INSTALLATION OR REMARKS
	Ground Surface						○ UNCONFINED + FIELD VANE; ● POCKET PEN. × LAB VANE			
0.0	110mm ASPHALT									
0.1	470mm FILL - Gravel, some sand, trace silt, dense, brown, dry		1	SS	44			○		
0.6	SILTY CLAY trace sand, trace gravel, very stiff to hard, brown, damp (GLACIAL TILL)		2	SS	36			○		
			3	SS	25			○		
1.8	End of Borehole									

NOTES:
Borehole was open and dry upon completion of drilling.

Terraprobe

LOG OF BOREHOLE WP1

PROJECT: Dixie Road Improvements **COORDINATES:** **DATE:** October 14, 2008

LOCATION: Brampton, Ontario **EQUIPMENT:** Solid Stem Augers

CLIENT: AECOM **ELEVATION DATUM:** n/a **FILE:** 1-10-5140

SOIL PROFILE			SAMPLES			ELEVATION SCALE	PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT	ORGANIC VAPOUR	STANDPIPE INSTALLATION OR REMARKS
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		20 40 60 80 100; ○ UNCONFINED + FIELD VANE; ● POCKET PEN. × LAB VANE	w_P w w_L; WATER CONTENT (%) 10 20 30	(ppm)	
	Ground Surface									
0.0	135mm ASPHALT									
0.1	325mm FILL - Sand, trace to some gravel, trace silt, compact, brown, damp		1	SS	16					
0.5	FILL - Silty Clay, trace sand, trace gravel, trace organics, inferred very stiff, grey, damp to moist		2	SS	19					
1.0	SILTY CLAY trace sand, trace gravel, inferred very stiff, brown, damp to moist (GLACIAL TILL)		3	AS						
1.5	End of Borehole									

NOTES:
Borehole was open and dry upon completion of drilling.

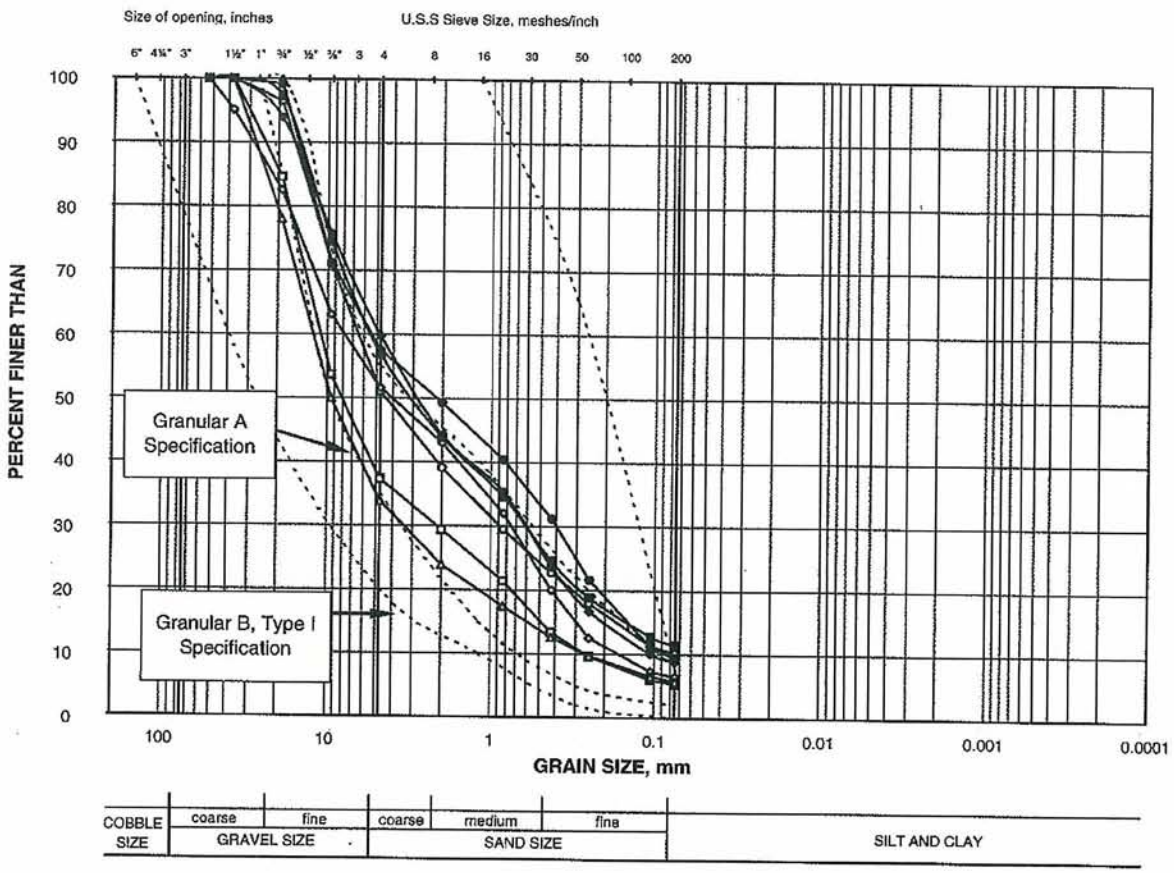
APPENDIX B

TERRAPROBE INC.

GRAIN SIZE DISTRIBUTION

FIGURE B1

GRANULAR BASE - SUBBASE MATERIAL



LEGEND				
SYMBOL	BOREHOLE	GRAVEL	SAND	SILT & CLAY
○	3	49%	41%	10%
◇	7	48%	46%	6%
□	15	63%	32%	5%
△	23	66%	28%	6%
●	27	42%	49%	9%
◆	10-2	40%	51%	9%
■	10-7	43%	46%	11%

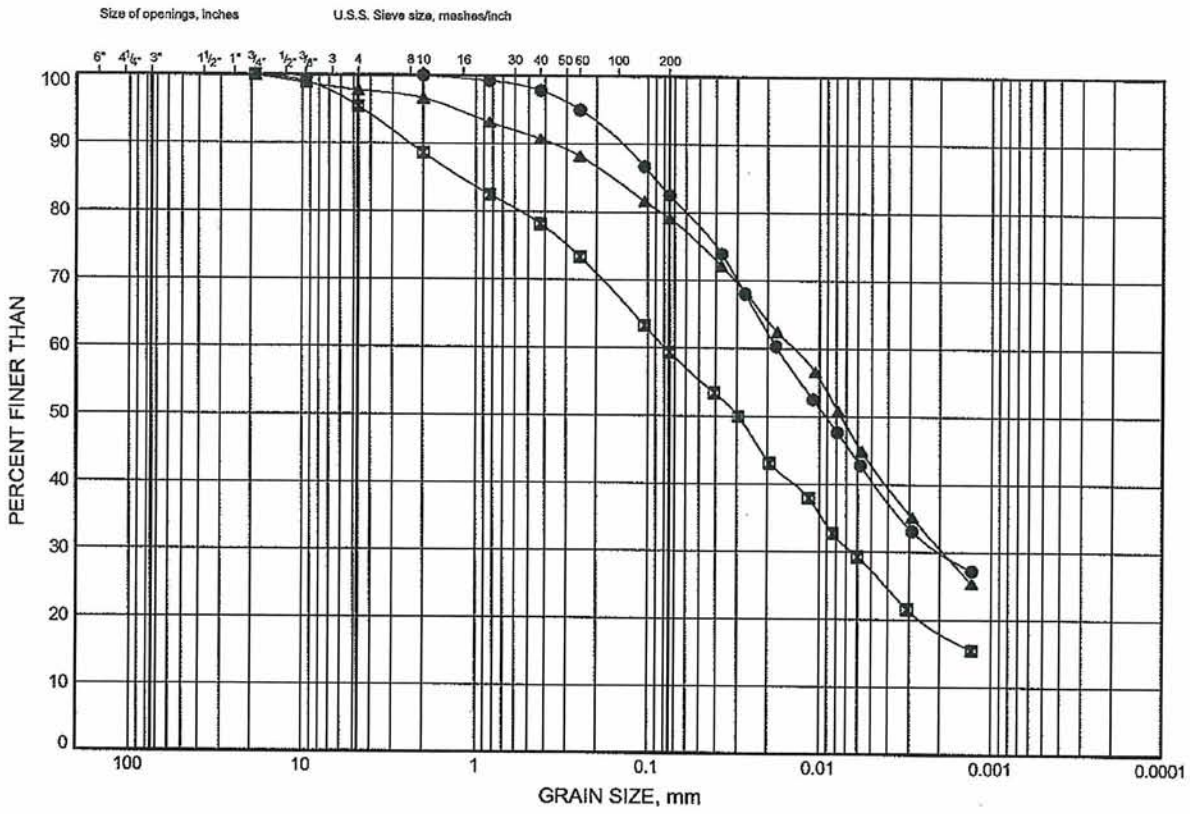
Date: August 2010
Project: 1-09-4136

Terraprobe Inc

GRAIN SIZE DISTRIBUTION

FIGURE B2

FILL - Silty Clay



COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	4	0.9	
⊠	15	0.9	
▲	10-1	1.5	

Date August 2010

Project 1-10-5140

Prep'd K.L.

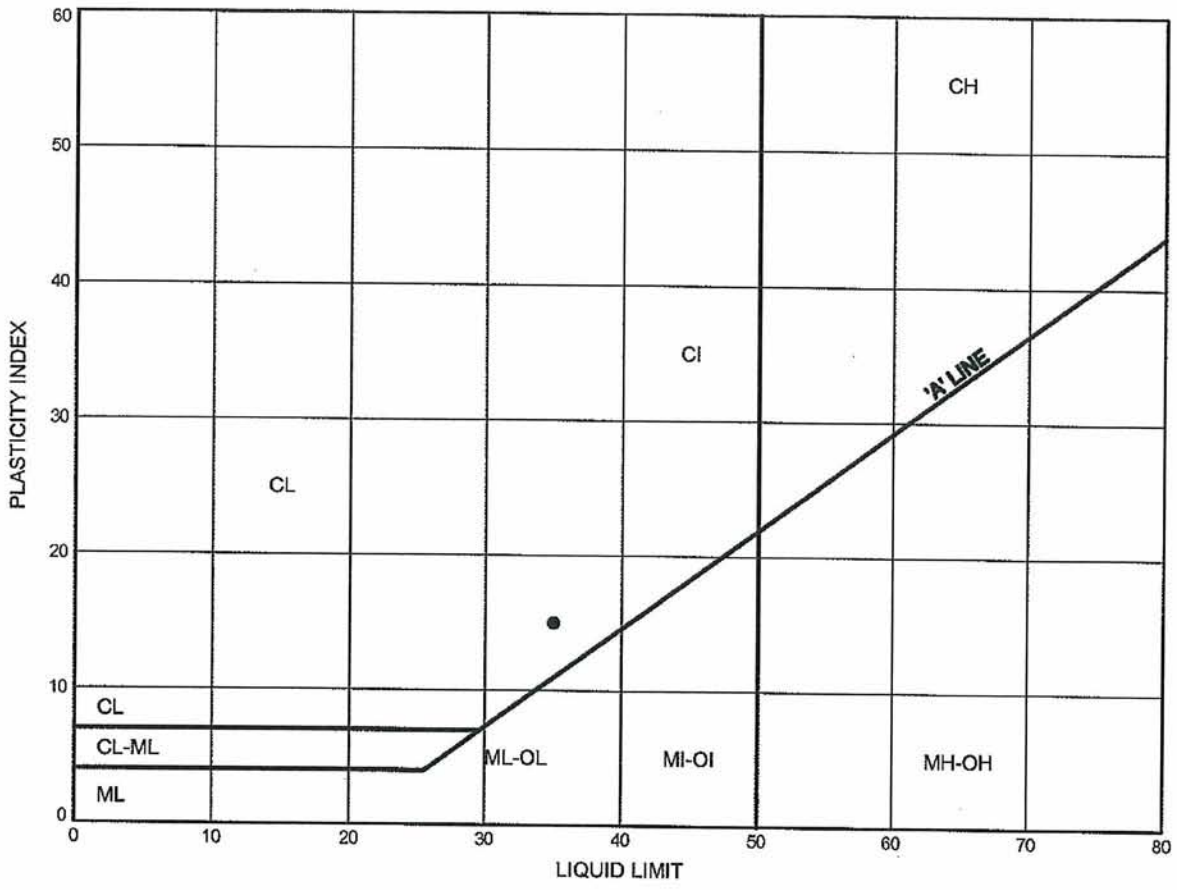
Chkd. M.P.

GSD 1-10-5140 DIXIE RD WIDENING.GPJ 08/20/10

ATTERBERG LIMITS TEST RESULTS

FIGURE B3

FILL - Silty Clay



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	10-1	1.5	

Date August 2010

Project 1-10-5140

Prep'd K.L.

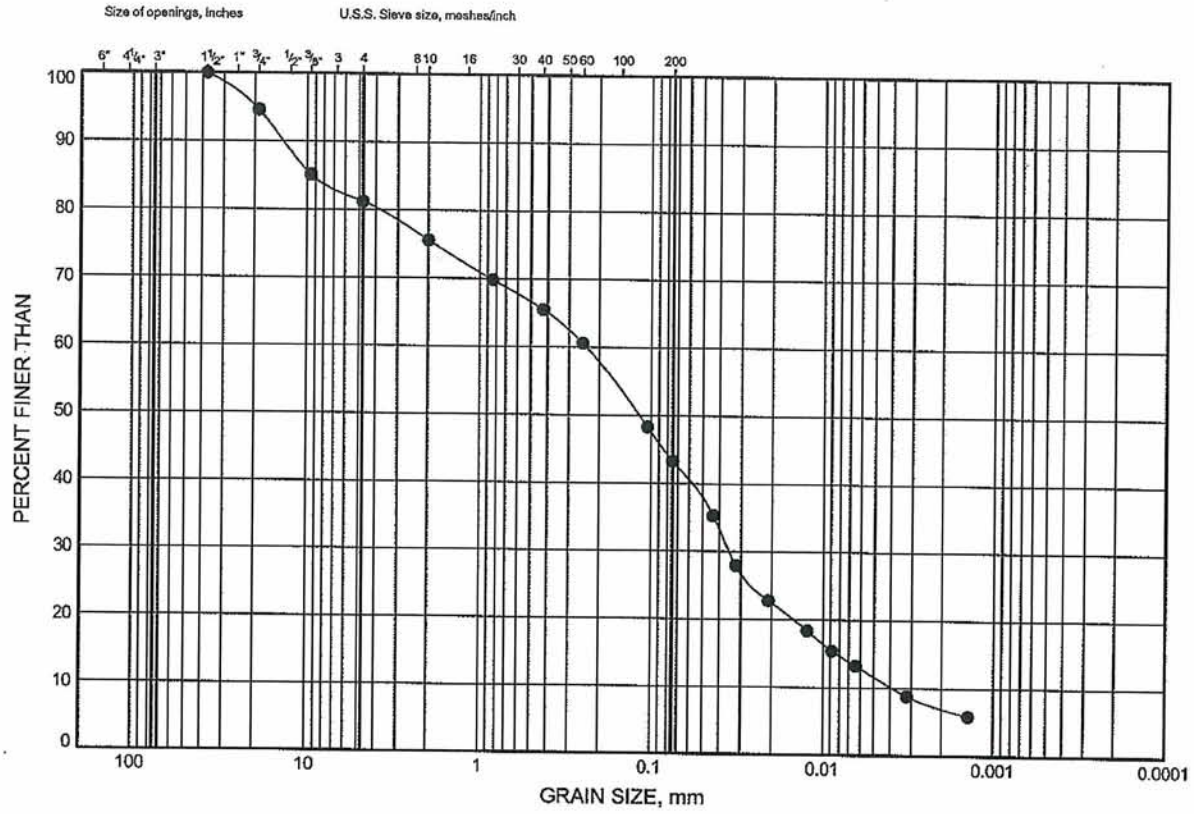
Chkd. M.P.

ALTR 1-10-5140 DIXIE RD WIDENING.GPJ 08/20/10

GRAIN SIZE DISTRIBUTION

FIGURE B4

FILL - Sand and Silt



COBBLE SIZE	GRAVEL		SAND			SILT and CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	FINE GRAINED

SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	14	0.9	

Date August 2010

Project 1-10-5140

Prep'd K.L.

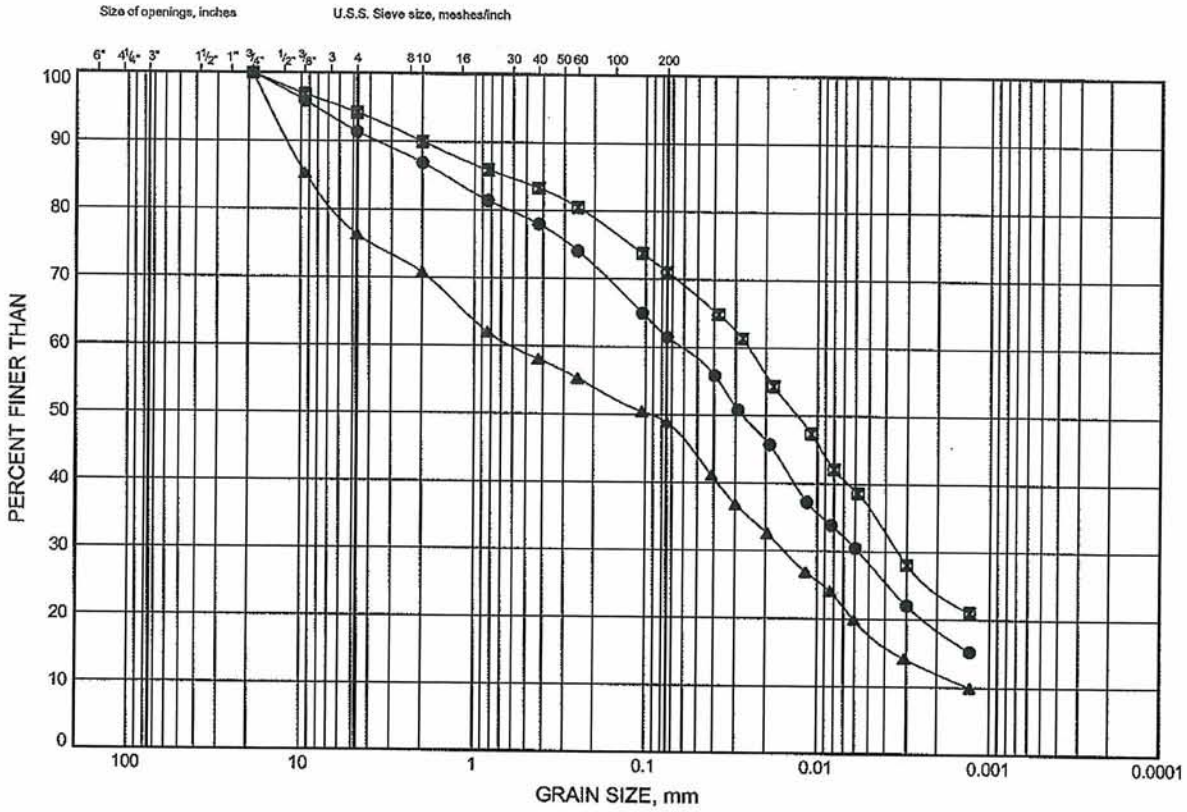
Chkd. M.P.

GSD 1-10-5140 DIXIE RD WIDENING.GPJ 08/20/10

GRAIN SIZE DISTRIBUTION

FIGURE B5

SILTY CLAY TO CLAYEY SILT TILL



COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	1	1.5	
⊠	30	0.9	
▲	10-5	7.9	93.3

Date August 2010

Project 1-10-5140

Prep'd K.L.

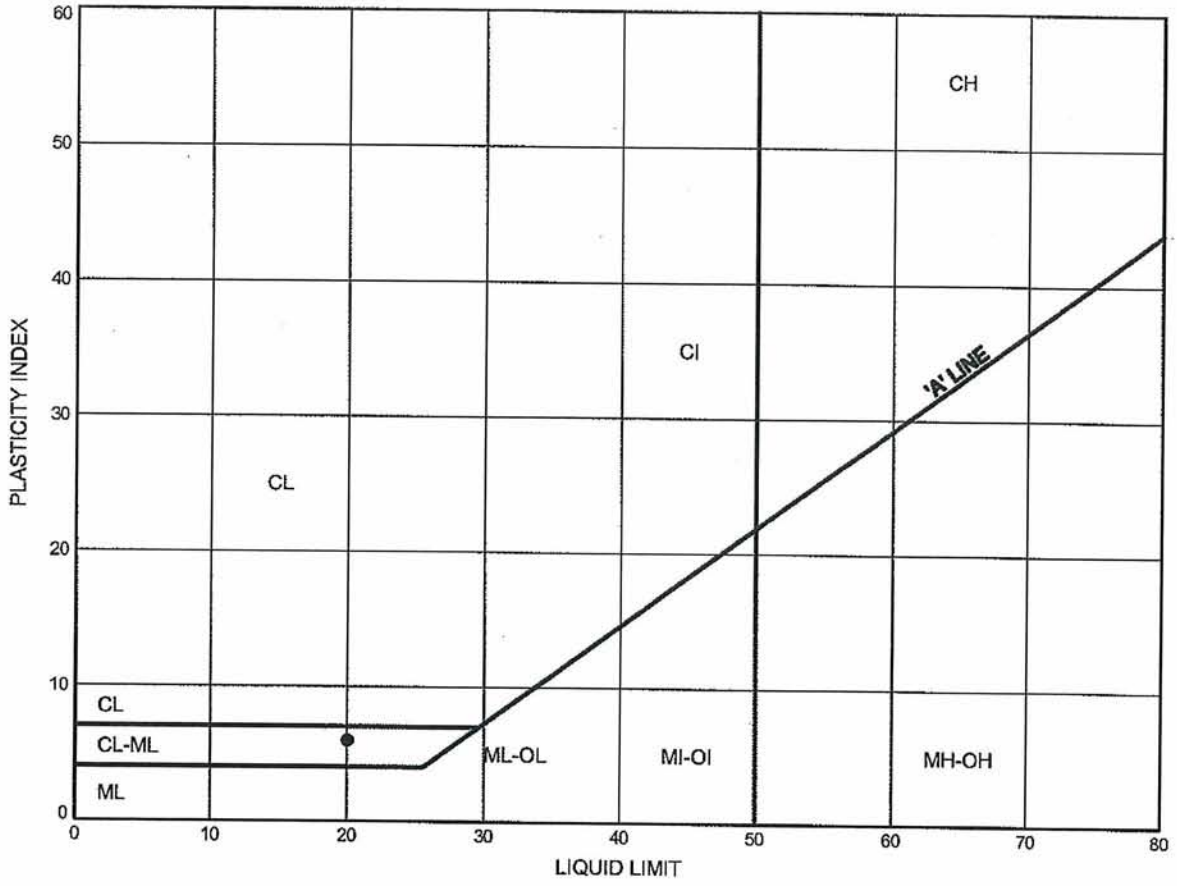
Chkd. M.P.

GSD 1-10-5140 DIXIE RD WIDENING.GPJ 08/20/10

ATTERBERG LIMITS TEST RESULTS

FIGURE B6

SILTY CLAY TO CLAYEY SILT TILL



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	10-5	7.9	93.3

Date August 2010

Project 1-10-5140

Prep'd K.L.

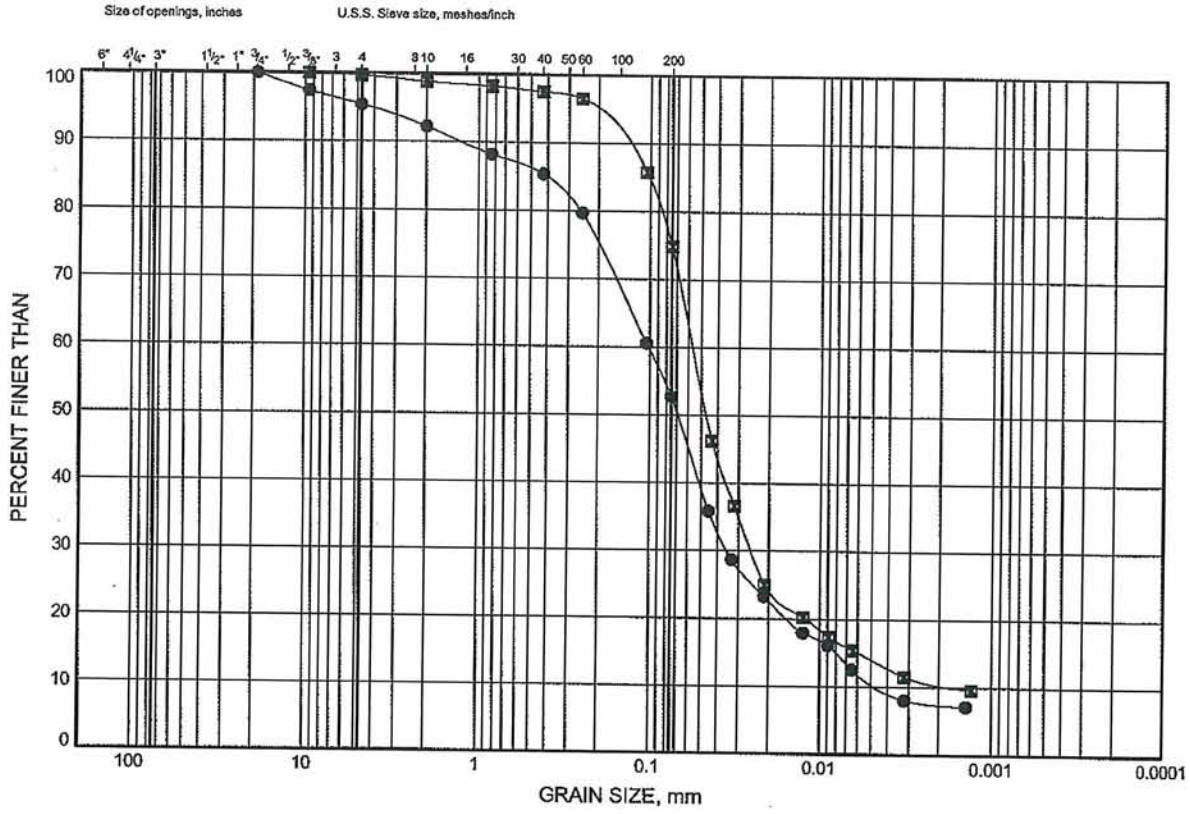
Chkd. M.P.

ALTR 1-10-5140 DIXIE RD WIDENING.GPJ 08/20/10

GRAIN SIZE DISTRIBUTION

FIGURE B7

SILT AND SAND



COBBLE SIZE	GRAVEL		SAND			SILT and CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	FINE GRAINED

SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	19	1.5	
⊠	29	1.5	

Date August 2010

Project 1-10-5140

Prep'd K.L.

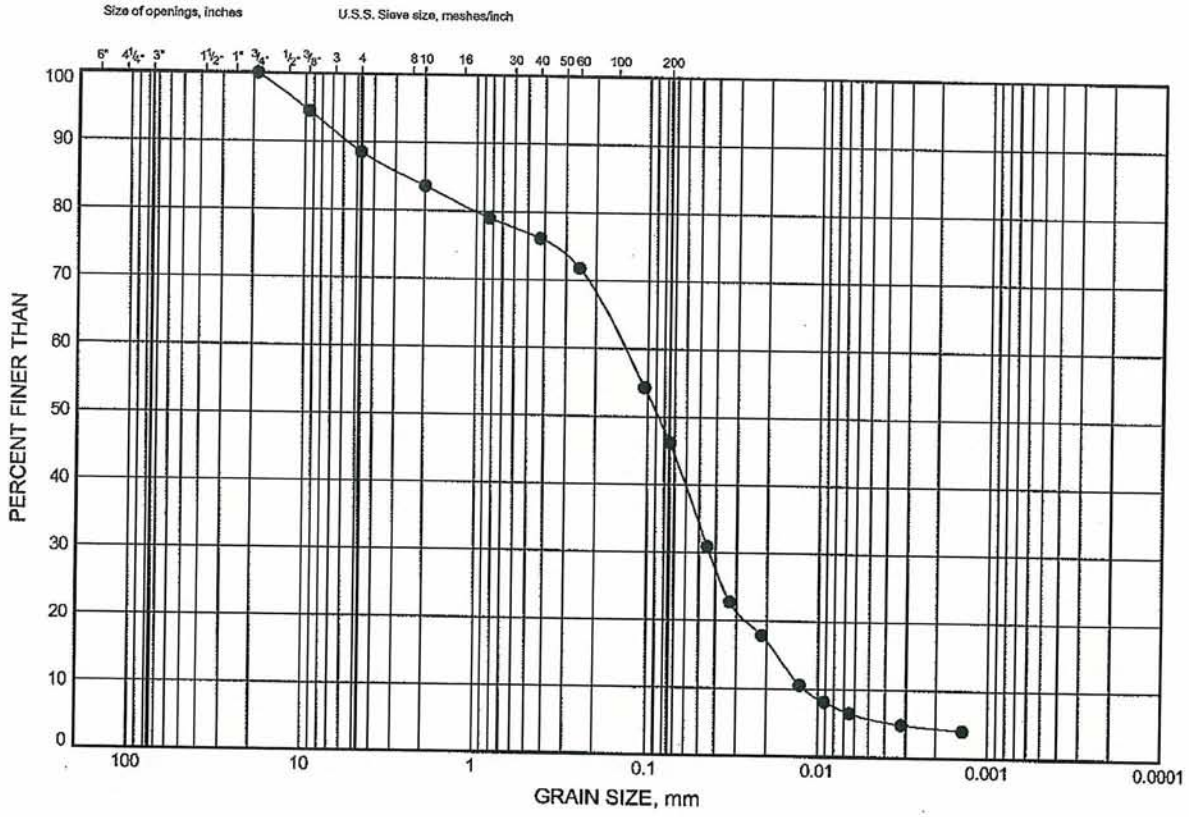
Chkd. M.P.

GSD 1-10-5140 DIXIE RD WIDENING.GPJ 08/20/10

GRAIN SIZE DISTRIBUTION

FIGURE B8

SAND AND SILT TILL



COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	34	3.2	214.5

Date August 2010

Project 1-10-5140

Prep'd K.L.

Chkd. M.P.

GSD 1-10-5140 DIXIE RD WIDENING.GPJ 08/20/10

APPENDIX C

TERRAPROBE INC.

Terraprobe

Core Photographs

Dixie Road Improvements

1-10-5140

BH 3
Dixie Rd Pavement

Type	Core (mm)
HL3	50
HL8	105
Total	155

BH7
Dixie Rd Pavement

Type	Core (mm)
HL3	35
HL8	115
Total	150

BH 11
Dixie Rd Pavement

Type	Core (mm)
HL3	60
HL8	85
Total	145

BH 15
Dixie Rd Pavement

Type	Core (mm)
HL3	50
HL8	115
Total	165

Terraprobe

Core Photographs

Dixie Road Improvements

1-10-5140

BH 23
Dixie Rd Pavement

Type	Core (mm)
HL3	45
HL8	90
Total	135

15mm of core lost during coring

BH 27
Dixie Rd Pavement

Type	Core (mm)
HL3	50
HL8	95
Total	145

BH NP1
Dixie Rd Pavement

Type	Core (mm)
HL3	40
HL8	100
Total	140

Flexible Pavement Condition Evaluation Form for Municipalities

Road No. (Street) Dixie Road (Regional Road 4) Location From Sta. 7+800 (N. of Queen Street) To Sta. 8+300 (Howden Boulevard)

Section Length 500 m (km) (m) Survey Date May 28, 2009 Traffic Direction [B]

B: Both Directions, N: North Bound
S: South Bound, E: East Bound, W: West Bound

Contract No. Work Project No. 1-10-5140 Class [A]

F: Freeway, C: Connecting Link, A: Major Arterial
M: Minor Arterial, R: Residential

Pavement Condition Rating (PCR) 70 Riding Condition Rating (RCR) 7 Evaluated By M. Talukdar, P. Eng.

Riding Condition Rating (at posted speed)			Severity of Distress			Density of Distress % (Extent of Occurrence)		
10 Excellent (smooth) / 8 Good (comfortable) / 6 Fair (uncomfortable) / 4 Poor (v. rough/bumpy) / 2 Very Poor, dangerous at posted speed / 0			Slight	Moderate	Severe	Intermittent	Frequent	Extensive
Pavement Distress Manifestation			1	2	3	<20 1	20-50 2	>50 3
Surface Defects	Ravelling	1						
	Flushing	2						
	Potholes	3	✓			✓		
	Pavement Edge Breaks	4						
	Manholes & Catchbasins	5		✓		✓		
Surface Deformation	Rippling & Shoving	6						
	Wheel Track Rutting	7						
	Distortion	8	✓			✓		
	Utility Trenches	9	✓			✓		
Cracking	Longitudinal	10		✓			✓	
	Transverse	11		✓			✓	
	Pavement Edge Breaks	12			✓		✓	
	Map	13	✓				✓	
	Alligator	14		✓		✓		

Distress Comments (Items not covered above)

Slight intermittent road side curb breaks.

Recommendation by Evaluator

See Terraprobe Geotechnical Report Ref. 1-10-5140

Shoulder Distress Manifestation			Severity of Distress						Density of Distress, % Extent of Occurrence					
			Right			Left			Right			Left		
Dominant TYPE	✓ one	Distress	slight	mod.	severe	slight	mod.	severe	<20	20-50	>50	<20	20-50	>50
			1	2	3	1	2	3	1	2	3	1	2	3
Paved Full		Pavement Edge												
		Paved Shoulder Separation												
Paved Partial		Cracking												
Surface Treated		Breakup and Potholes												
		Distortion												
Primed		Pavement Edge Curb Separation												

Maintenance Treatment

Pavement	Extent of Occurrence, % <20	20-50	>50
	1	2	3
Manual Patching	✓		
Machine Patching			
Manual Spray Patching			
Manual Chip Seal			
Fog Seal			
Surface Treatment			
Manual Burn & Seal			
Crack Rout & Seal	✓		

Shoulder	Extent of Occurrence, % <20	20-50	>50
	1	2	3
Manual Patching			
Manual Spray Patching			
Manual Chip Seal			
Crack Rout & Seal			

Flexible Pavement Condition Evaluation Form for Municipalities

Road No. (Street) Dixie Road (Regional Road 4) Location From Sta. 8+300 (Howden Boulevard) To Sta. 9+500 (Mansion Street)

Section Length 1,200 m (km) (m) Survey Date May 28, 2009 Traffic Direction B

B: Both Directions, N: North Bound
S: South Bound, E: East Bound, W: West Bound

Contract No. Work Project No. 1-10-5140 Class A

F: Freeway, C: Connecting Link, A: Major Arterial
M: Minor Arterial, R: Residential

Pavement Condition Rating (PCR) 80 Riding Condition Rating (RCR) 8 Evaluated By M. Talukdar, P. Eng.

Riding Condition Rating (at posted speed)			Severity of Distress			Density of Distress % (Extent of Occurrence)		
10 Excellent (smooth) 8 Good (comfortable) 6 Fair (uncomfortable) 4 Poor (v. rough/bumpy) 2 Very Poor, dangerous at posted speed 0			Slight	Moderate	Severe	Intermittent	Frequent	Extensive
Pavement Distress Manifestation			1	2	3	<20 1	20-50 2	>50 3
Surface Defects	Ravelling	1						
	Flushing	2						
	Potholes	3						
	Pavement Edge Breaks	4						
	Manholes & Catchbasins	5	✓			✓		
Surface Deformation	Rippling & Shoving	6						
	Wheel Track Rutting	7						
	Distortion	8	✓			✓		
	Utility Trenches	9	✓			✓		
Cracking	Longitudinal	10	✓			✓		
	Transverse	11	✓			✓		
	Pavement Edge Breaks	12	✓			✓		
	Map	13	✓			✓		
	Alligator	14						

Distress Comments (Items not covered above)

Recommendation by Evaluator

See Terraprobe Geotechnical Report Ref. 1-10-5140

Shoulder Distress Manifestation			Severity of Distress						Density of Distress, % Extent of Occurrence					
			Right			Left			Right			Left		
Dominant TYPE	✓ one	Distress	slight	mod.	severe	slight	mod.	severe	<20	20-50	>50	<20	20-50	>50
			1	2	3	1	2	3	1	2	3	1	2	3
Paved Full		Pavement Edge												
		Paved Shoulder Separation												
Paved Partial		Cracking												
Surface Treated		Breakup and Potholes												
		Distortion												
Primed		Pavement Edge Curb Separation												

Maintenance Treatment								
Pavement	Extent of Occurrence, %			Shoulder	Extent of Occurrence, %		
	<20	20-50	>50		<20	20-50	>50
	1	2	3		1	2	3
Manual Patching	✓			Manual Patching			
Machine Patching				Manual Spray Patching			
Manual Spray Patching				Manual Chip Seal			
Manual Chip Seal				Crack Rout & Seal			
Fog Seal							
Surface Treatment							
Manual Burn & Seal							
Crack Rout & Seal	✓						

Flexible Pavement Condition Evaluation Form for Municipalities

Road No. (Street): Dixie Road (Regional Road 4) | Location From: Sta. 9+500 (Mansion Street) | To: Sta. 9+900 (North Park Drive)

Section Length: 400 m (km) (m) | Survey Date: May 28, 2009 | Traffic Direction: B (B: Both Directions, N: North Bound, S: South Bound, E: East Bound, W: West Bound)

Contract No. | Work Project No. 1-10-5140 | Class: A (F: Freeway, C: Connecting Link, A: Major Arterial, M: Minor Arterial, R: Residential)

Pavement Condition Rating (PCR): 75 | Riding Condition Rating (RCR): 7 | Evaluated By: M. Talukdar, P. Eng.

Riding Condition Rating (at posted speed)		Severity of Distress			Density of Distress % (Extent of Occurrence)		
10 Excellent (smooth)		Slight	Moderate	Severe	Intermittent	Frequent	Extensive
8 Good (comfortable)							
6 Fair (uncomfortable)							
4 Poor (v. rough/bumpy)							
2 Very Poor, dangerous at posted speed							
0							
Pavement Distress Manifestation		1	2	3	<20 1	20-50 2	>50 3
Surface Defects	Ravelling	1					
	Flushing	2					
	Potholes	3		✓		✓	
	Pavement Edge Breaks	4	✓			✓	
	Manholes & Catchbasins	5					
Surface Deformation	Rippling & Shoving	6					
	Wheel Track Rutting	7					
	Distortion	8	✓			✓	
	Utility Trenches	9					
Cracking	Longitudinal	10		✓			✓
	Transverse	11	✓				✓
	Pavement Edge Breaks	12		✓		✓	
	Map	13	✓			✓	
	Alligator	14					

Distress Comments (Items not covered above)

Recommendation by Evaluator

See Terraprobe Geotechnical Report Ref. 1-10-5140

Shoulder Distress Manifestation			Severity of Distress						Density of Distress, % Extent of Occurrence					
			Right			Left			Right			Left		
Dominant TYPE	✓ one	Distress	slight 1	mod. 2	severe 3	slight 1	mod. 2	severe 3	<20 1	20-50 2	>50 3	<20 1	20-50 2	>50 3
Paved Full		Pavement Edge												
		Paved Shoulder Separation												
Paved Partial		Cracking												
Surface Treated		Breakup and Potholes												
		Distortion												
Primed		Pavement Edge Curb Separation												

Maintenance Treatment							
Pavement	Extent of Occurrence, % <20 1	20-50 2	>50 3	Shoulder	Extent of Occurrence, % <20 1	20-50 2	>50 3
Manual Patching	✓			Manual Patching			
Machine Patching	✓			Manual Spray Patching			
Manual Spray Patching				Manual Chip Seal			
Manual Chip Seal				Crack Rout & Seal			
Fog Seal							
Surface Treatment							
Manual Burn & Seal							
Crack Rout & Seal	✓						

Flexible Pavement Condition Evaluation Form for Municipalities

Road No. (Street) Dixie Road (Regional Road 4) Location From Sta. 9+900 (North Park Drive) To Sta. 10+700 (Bovaird Drive)

Section Length 800 m (km) (m) Survey Date May 28, 2009 Traffic Direction [B]

B: Both Directions, N: North Bound
S: South Bound, E: East Bound, W: West Bound

Contract No. Work Project No. 1-10-5140 Class [A]

F: Freeway, C: Connecting Link, A: Major Arterial
M: Minor Arterial, R: Residential

Pavement Condition Rating (PCR) 75 Riding Condition Rating (RCR) 7 Evaluated By M. Talukdar, P. Eng.

Riding Condition Rating (at posted speed)			Severity of Distress			Density of Distress % (Extent of Occurrence)		
10 Excellent (smooth) / 8 Good (comfortable) / 6 Fair (uncomfortable) / 4 Poor (v. rough/bumpy) / 2 / 0 Very Poor, dangerous at posted speed			Slight	Moderate	Severe	Intermittent	Frequent	Extensive
Pavement Distress Manifestation			1	2	3	<20 1	20-50 2	>50 3
Surface Defects	Ravelling	1						
	Flushing	2						
	Potholes	3	✓			✓		
	Pavement Edge Breaks	4						
	Manholes & Catchbasins	5			✓		✓	
Surface Deformation	Rippling & Shoving	6	✓			✓		
	Wheel Track Rutting	7						
	Distortion	8	✓			✓		
	Utility Trenches	9						
Cracking	Longitudinal	10		✓			✓	
	Transverse	11	✓			✓		
	Pavement Edge Breaks	12	✓			✓		
	Map	13	✓			✓		
	Alligator	14						

Distress Comments (Items not covered above)

Recommendation by Evaluator

See Terraprobe Geotechnical Report Ref. 1-10-5140

Shoulder Distress Manifestation			Severity of Distress						Density of Distress, % Extent of Occurrence					
			Right			Left			Right			Left		
Dominant TYPE	✓ one	Distress	slight 1	mod. 2	severe 3	slight 1	mod. 2	severe 3	<20 1	20-50 2	>50 3	<20 1	20-50 2	>50 3
Paved Full		Pavement Edge												
		Paved Shoulder Separation												
Paved Partial		Cracking												
Surface Treated		Breakup and Potholes												
		Distortion												
Primed		Pavement Edge Curb Separation												

Maintenance Treatment						
Pavement	Extent of Occurrence, %			Shoulder	Extent of Occurrence, %		
	<20 1	20-50 2	>50 3		<20 1	20-50 2	>50 3
Manual Patching	✓			Manual Patching			
Machine Patching	✓			Manual Spray Patching			
Manual Spray Patching				Manual Chip Seal			
Manual Chip Seal				Crack Rout & Seal			
Fog Seal							
Surface Treatment							
Manual Burn & Seal							
Crack Rout & Seal	✓						

Flexible Pavement Condition Evaluation Form for Municipalities

Road No. (Street) Dixie Road (Regional Road 4) Location From Sta. 10+700 (Bovaird Drive) To Sta. 13+750 (Countryside Drive)

Section Length 3,050 m (km) (m) Survey Date May 28, 2009 Traffic Direction [B]

B: Both Directions, N: North Bound
S: South Bound, E: East Bound, W: West Bound

Contract No. Work Project No. 1-10-5140 Class [A]

F: Freeway, C: Connecting Link, A: Major Arterial
M: Minor Arterial, R: Residential

Pavement Condition Rating (PCR) 85 Riding Condition Rating (RCR) 8 Evaluated By M. Talukdar, P. Eng.

Riding Condition Rating (at posted speed)			Severity of Distress			Density of Distress % (Extent of Occurrence)		
10 Excellent (smooth)			Slight	Moderate	Severe	Intermittent	Frequent	Extensive
8 Good (comfortable)								
6 Fair (uncomfortable)								
4 Poor (v. rough/bumpy)								
2 Very Poor, dangerous at posted speed								
0	**Pavement Distress Manifestation**		1	2	3	<20 1	20-50 2	>50 3
Surface Defects	Ravelling	1						
	Flushing	2						
	Potholes	3	✓			✓		
	Pavement Edge Breaks	4						
	Manholes & Catchbasins	5		✓		✓		
Surface Deformation	Rippling & Shoving	6						
	Wheel Track Rutting	7						
	Distortion	8	✓			✓		
	Utility Trenches	9	✓			✓		
Cracking	Longitudinal	10	✓			✓		
	Transverse	11	✓			✓		
	Pavement Edge Breaks	12						
	Map	13						
	Alligator	14						

Distress Comments (Items not covered above)

Recommendation by Evaluator

See Terraprobe Geotechnical Report Ref. 1-10-5140

Shoulder Distress Manifestation			Severity of Distress						Density of Distress, % Extent of Occurrence					
			Right			Left			Right			Left		
Dominant TYPE	✓ one	Distress	slight	mod.	severe	slight	mod.	severe	<20	20-50	>50	<20	20-50	>50
			1	2	3	1	2	3	1	2	3	1	2	3
Paved Full		Pavement Edge												
		Paved Shoulder Separation												
Paved Partial		Cracking												
Surface Treated		Breakup and Potholes												
		Distortion												
Primed		Pavement Edge Curb Separation												

Maintenance Treatment

Pavement	Extent of Occurrence, %			Shoulder	Extent of Occurrence, %		
	<20	20-50	>50		<20	20-50	>50
	1	2	3		1	2	3
Manual Patching				Manual Patching			
Machine Patching				Manual Spray Patching			
Manual Spray Patching				Manual Chip Seal			
Manual Chip Seal				Crack Rout & Seal			
Fog Seal							
Surface Treatment							
Manual Burn & Seal							
Crack Rout & Seal	✓						

Flexible Pavement Condition Evaluation Form for Municipalities

Road No. (Street): Dixie Road (Regional Road 4) | Location From: Sta. 13+750 (Countryside Drive) | To: Sta. 15+000 (Mayfield Road)

Section Length: 1,250 m (km) (m) | Survey Date: May 28, 2009 | Traffic Direction: B (B: Both Directions, N: North Bound, S: South Bound, E: East Bound, W: West Bound)

Contract No.: | Work Project No.: 1-10-5140 | Class: A (F: Freeway, C: Connecting Link, A: Major Arterial, M: Minor Arterial, R: Residential)

Pavement Condition Rating (PCR): 80 | Riding Condition Rating (RCR): 8 | Evaluated By: M. Talukdar, P. Eng.

Riding Condition Rating (at posted speed)			Severity of Distress			Density of Distress % (Extent of Occurrence)		
10 Excellent (smooth)			Slight	Moderate	Severe	Intermittent	Frequent	Extensive
8 Good (comfortable)								
6 Fair (uncomfortable)								
4 Poor (v. rough/bumpy)								
2 Very Poor, dangerous at posted speed								
0	**Pavement Distress Manifestation**		1	2	3	<20	20-50	>50
						1	2	3
Surface Defects	Ravelling	1	✓			✓		
	Flushing	2						
	Potholes	3	✓			✓		
	Pavement Edge Breaks	4	✓			✓		
	Manholes & Catchbasins	5		✓			✓	
Surface Deformation	Rippling & Shoving	6						
	Wheel Track Rutting	7						
	Distortion	8						
	Utility Trenches	9	✓			✓		
Cracking	Longitudinal	10	✓				✓	
	Transverse	11	✓			✓		
	Pavement Edge Breaks	12	✓			✓		
	Map	13	✓			✓		
	Alligator	14						

Distress Comments (Items not covered above)

Recommendation by Evaluator

See Terraprobe Geotechnical Report Ref. 1-10-5140

Shoulder Distress Manifestation			Severity of Distress						Density of Distress, % Extent of Occurrence					
			Right			Left			Right			Left		
Dominant TYPE	✓ one	Distress	slight	mod.	severe	slight	mod.	severe	<20	20-50	>50	<20	20-50	>50
			1	2	3	1	2	3	1	2	3	1	2	3
Paved Full		Pavement Edge												
		Paved Shoulder Separation												
Paved Partial		Cracking												
Surface Treated		Breakup and Potholes												
		Distortion												
Primed		Pavement Edge Curb Separation												

Maintenance Treatment

Pavement	Extent of Occurrence, %			Shoulder	Extent of Occurrence, %		
	<20	20-50	>50		<20	20-50	>50
	1	2	3		1	2	3
Manual Patching				Manual Patching			
Machine Patching				Manual Spray Patching			
Manual Spray Patching				Manual Chip Seal			
Manual Chip Seal				Crack Rout & Seal			
Fog Seal							
Surface Treatment							
Manual Burn & Seal							
Crack Rout & Seal	✓						

Flexible Pavement Condition Evaluation Form for Municipalities

Road No. (Street) Dixie Road (Regional Road 4) Location From Sta. 15+000 (Mayfield Road) To Sta. 17+064 (North Project Limit)

Section Length 2,064 m (km) (m) Survey Date Aug. 09, 2010 Traffic Direction B

B: Both Directions, N: North Bound
S: South Bound, E: East Bound, W: West Bound

Contract No. Work Project No. 1-10-5140 Class A

F: Freeway, C: Connecting Link, A: Major Arterial
M: Minor Arterial, R: Residential

Pavement Condition Rating (PCR) 90 Riding Condition Rating (RCR) 9 Evaluated By M. Paoliello, E.I.T.

Riding Condition Rating (at posted speed)			Severity of Distress			Density of Distress % (Extent of Occurrence)		
10 Excellent (smooth)								
8 Good (comfortable)								
6 Fair (uncomfortable)								
4 Poor (v. rough/bumpy)								
2 Very Poor, dangerous at posted speed			Slight	Moderate	Severe	Intermittent	Frequent	Extensive
0	**Pavement Distress Manifestation**		1	2	3	<20	20-50	>50
Surface Defects	Ravelling	1	✓			✓		
	Flushing	2						
	Potholes	3						
	Pavement Edge Breaks	4						
	Manholes & Catchbasins	5						
Surface Deformation	Rippling & Shoving	6						
	Wheel Track Rutting	7						
	Distortion	8						
	Utility Trenches	9						
Cracking	Longitudinal	10						
	Transverse	11						
	Pavement Edge Breaks	12						
	Map	13						
	Alligator	14						

Shoulder Distress Manifestation			Severity of Distress						Density of Distress, % Extent of Occurrence					
			Right			Left			Right			Left		
Dominant TYPE	✓ one	Distress	slight	mod.	severe	slight	mod.	severe	<20	20-50	>50	<20	20-50	>50
			1	2	3	1	2	3	1	2	3	1	2	3
Paved Full		Pavement Edge												
		Paved Shoulder Separation												
Paved Partial	T	Cracking	✓			✓				✓			✓	
Surface Treated		Breakup and Potholes												
		Distortion												
Primed		Pavement Edge Curb Separation												

Maintenance Treatment

Pavement	Extent of Occurrence, % <20	20-50	>50
	1	2	3
Manual Patching			
Machine Patching			
Manual Spray Patching			
Manual Chip Seal			
Fog Seal			
Surface Treatment			
Manual Burn & Seal			
Crack Rout & Seal			

Shoulder	Extent of Occurrence, % <20	20-50	>50
	1	2	3
Manual Patching			
Manual Spray Patching			
Manual Chip Seal			
Crack Rout & Seal			

Distress Comments (Items not covered above)

-Moderate distortion at Sta. 15+900 and Sta. 16+275 above existing CSP's.
-HMA overlay recently placed on existing pavement.

Recommendation by Evaluator

See Terraprobe Geotechnical Report Ref. 1-10-5140

APPENDIX D

TERRAPROBE INC.

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 09T338709

PROJECT NO: 1-08-3219

CLIENT NAME: TERRAPROBE LIMITED

ATTENTION TO: Rehman Abdul

O. Reg. 153 Metals & Inorganics in Soil - Table 1

DATE SAMPLED: Jun 18, 2009 | **DATE RECEIVED: Jun 18, 2009** | **DATE REPORTED: Jun 29, 2009** | **SAMPLE TYPE: Soil**

Parameter	Unit	G / S	RDL	1-SS1 1360014	5-SS2 1360020	9-SS1 1360021	12-SS2 1360022
Antimony	µg/g	1.0	0.8	<0.8	<0.8	<0.8	<0.8
Arsenic	µg/g	17	0.3	2.9	4.2	3.5	4.8
Barium	µg/g	210	0.2	59.0	121	87.3	62.0
Beryllium	µg/g	1.2	0.2	0.3	0.8	0.9	0.6
Boron (Hot Water Extractable)	µg/g		0.10	0.17	0.11	0.15	0.47
Cadmium	µg/g	1.0	0.2	<0.2	<0.2	<0.2	<0.2
Chromium	µg/g	71	0.3	8.5	17.4	16.6	16.7
Cobalt	µg/g	21	0.2	5.9	12.0	9.7	11.5
Copper	µg/g	85	0.2	27.7	35.0	30.3	34.3
Lead	µg/g	120	0.3	6.9	8.4	11.9	10.5
Molybdenum	µg/g	2.5	0.3	0.3	<0.3	0.4	<0.3
Nickel	µg/g	43	0.3	7.7	21.0	17.6	20.6
Selenium	µg/g	1.9	0.4	<0.4	<0.4	<0.4	<0.4
Silver	µg/g	0.42	0.2	<0.2	<0.2	<0.2	<0.2
Thallium	µg/g	2.5	0.2	<0.2	<0.2	<0.2	<0.2
Vanadium	µg/g	91	0.2	11.6	23.5	23.9	19.5
Zinc	µg/g	160	0.2	17.5	44.6	41.4	39.6
Chromium, Hexavalent	µg/g	2.5	0.40	<0.40	<0.40	<0.40	<0.40
Cyanide, Free	µg/g	0.12	0.08	<0.08	<0.08	<0.08	<0.08
Mercury	µg/g	0.23	0.011	0.022	0.013	0.016	0.014
Electrical Conductivity (2:1)	mS/cm	0.57	0.002	**2.72**	**0.710**	**1.20**	**1.33**
Sodium Adsorption Ratio (2:1)	N/A	2.4	N/A	**44.6**	**11.4**	**15.3**	**3.52**
pH, 2:1 CaCl2 Extraction	N/A		N/A	8.19	8.12	7.93	7.94
Chloride (2:1)	µg/g	330	10	**1710**	313	**567**	**778**
Nitrate + Nitrite (2:1)	µg/g	61	1.0	<1.0	1.1	<1.0	2.6

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to T1(All)

1360014-1360022 EC, SAR, Chloride & Nitrate/Nitrite were determined on the extract obtained from the 2:1 leaching procedure (2 parts DI water:1 part soil).
pH was determined on the extract obtained from the 2:1 leaching procedure (2 parts 0.01M CaCl2:1 part soil).

Certified By:

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Guideline Violation

AGAT WORK ORDER: 09T338709

PROJECT NO: 1-08-3219

CLIENT NAME: TERRAPROBE LIMITED

ATTENTION TO: Rehman Abdul

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	GUIDEVALUE	RESULT
1360014	1-SS1	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Chloride (2:1)	330	1710
1360014	1-SS1	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Electrical Conductivity (2:1)	0.57	2.72
1360014	1-SS1	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Sodium Adsorption Ratio (2:1)	2.4	44.6
1360020	5-SS2	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Electrical Conductivity (2:1)	0.57	0.710
1360020	5-SS2	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Sodium Adsorption Ratio (2:1)	2.4	11.4
1360021	9-SS1	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Chloride (2:1)	330	567
1360021	9-SS1	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Electrical Conductivity (2:1)	0.57	1.20
1360021	9-SS1	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Sodium Adsorption Ratio (2:1)	2.4	15.3
1360022	12-SS2	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Chloride (2:1)	330	778
1360022	12-SS2	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Electrical Conductivity (2:1)	0.57	1.33
1360022	12-SS2	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Sodium Adsorption Ratio (2:1)	2.4	3.52